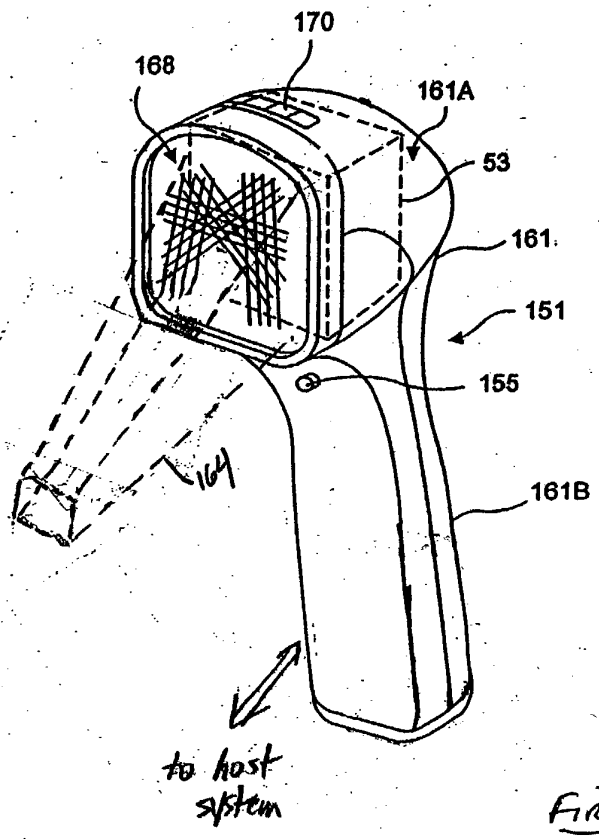


FIRST Generalized Embodiment

FIG. 1A

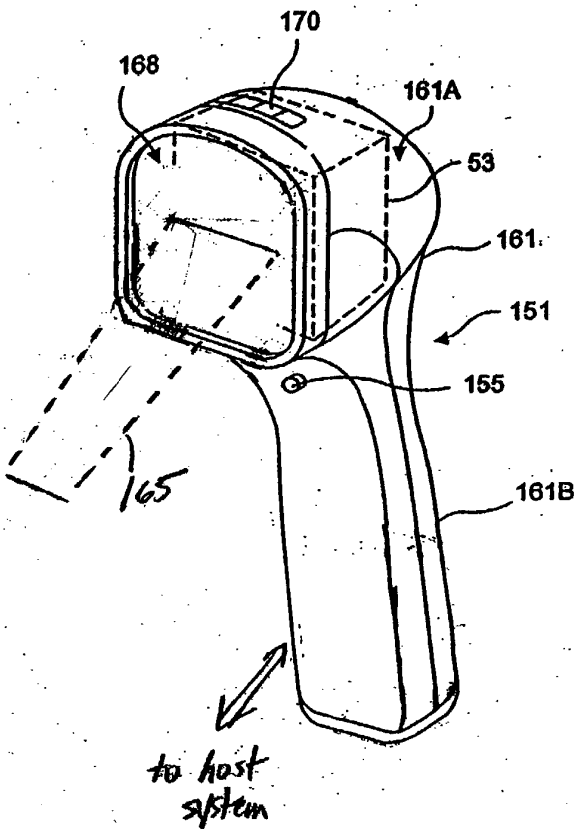
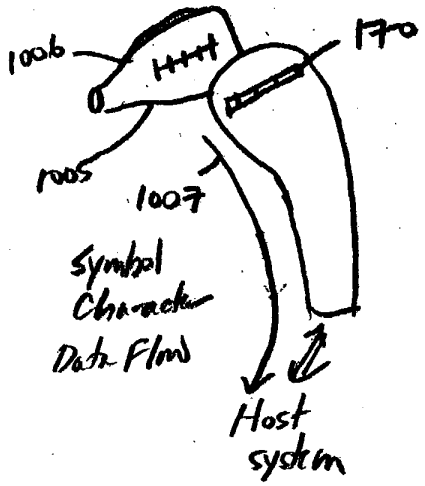


FIG 1B



OMNI-DIRECTIONAL Mode

FIG. 2A

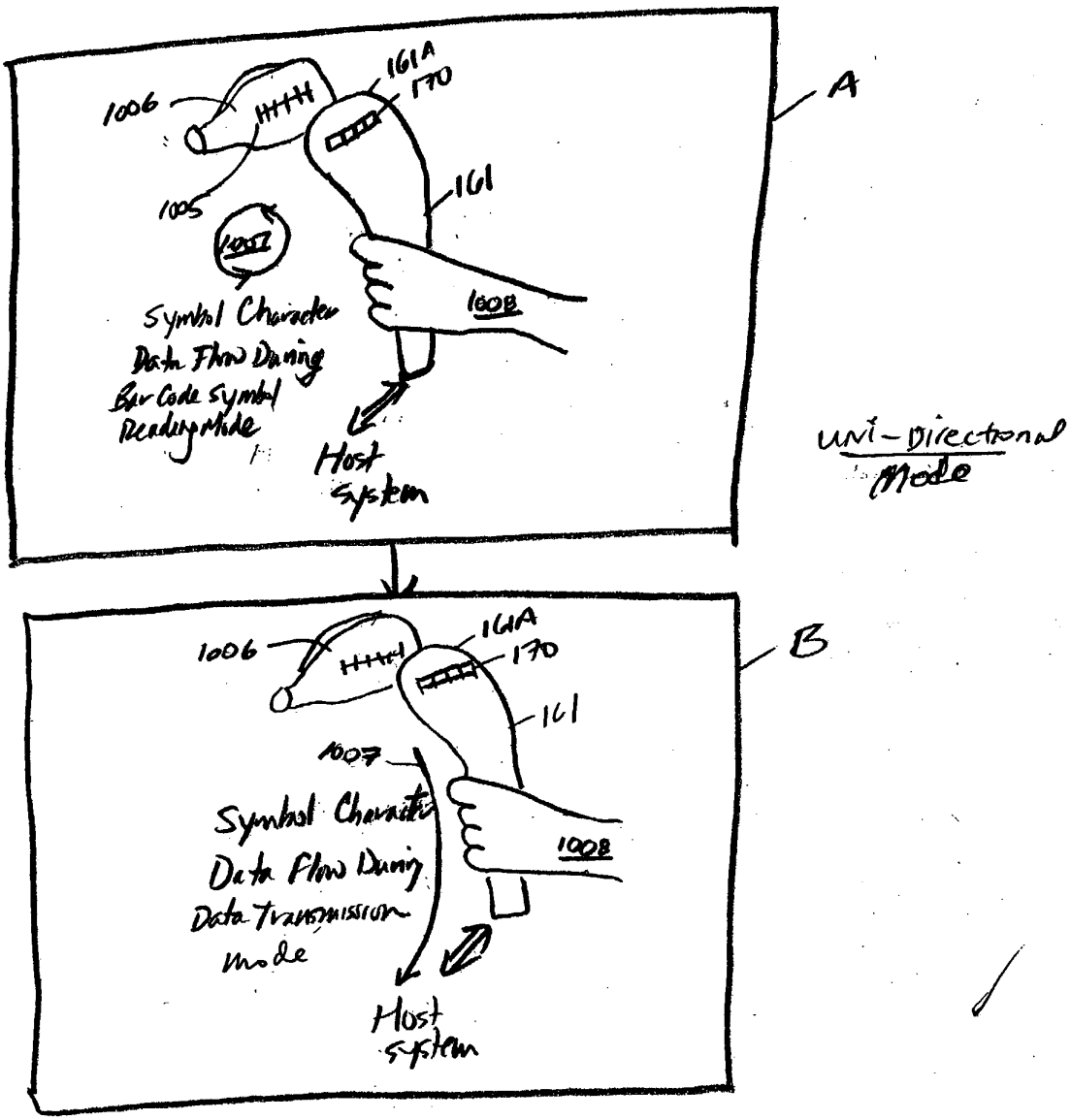

A
1006
161A
170
161
105
1007
Symbol Character Data Flow During Bar Code Symbol Reading Mode
160B
Host System
Uni-Directional Mode
B
1006
161A
170
161
1007
Symbol Character Data Flow During Data Transmission Mode
160B
Host System

FIG. 2B

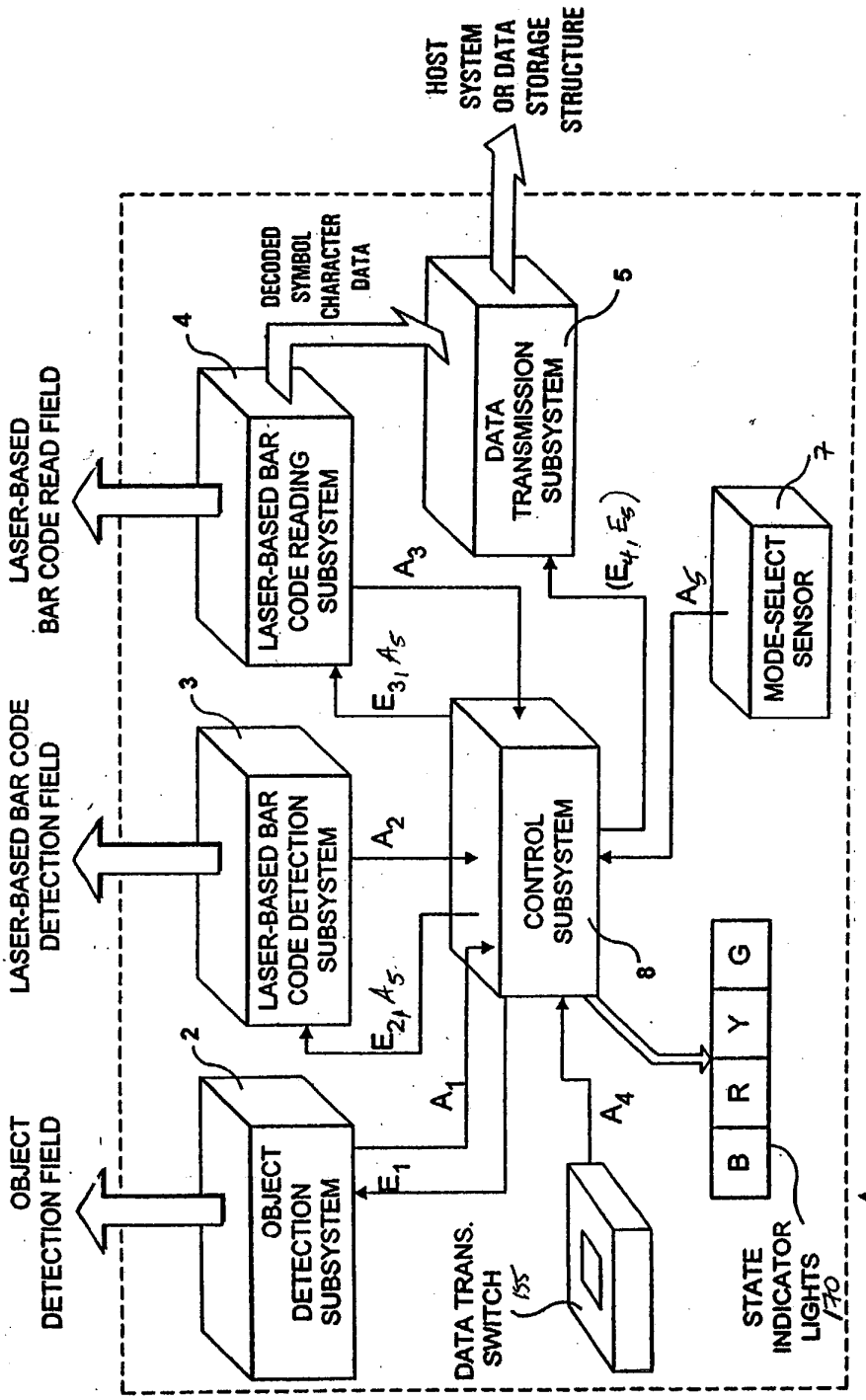

HOST SYSTEM OR DATA STORAGE STRUCTURE
DECODED SYMBOL CHARACTER DATA
LASER-BASED BAR CODE READ FIELD
LASER-BASED BAR CODE DETECTION FIELD
OBJECT DETECTION FIELD
LASER-BASED BAR CODE READING SUBSYSTEM
LASER-BASED BAR CODE DETECTION SUBSYSTEM
OBJECT DETECTION SUBSYSTEM
DATA TRANSMISSION SUBSYSTEM
CONTROL SUBSYSTEM
MODE-SELECT SENSOR
DATA TRANS. SWITCH
STATE INDICATOR LIGHTS
B
R
Y
G
A1
A2
A3
A4
A5
E1
E2, A5
E3, A5
(E4, E5)
2
3
4
5
7
8
150
155
157

FIG. 3

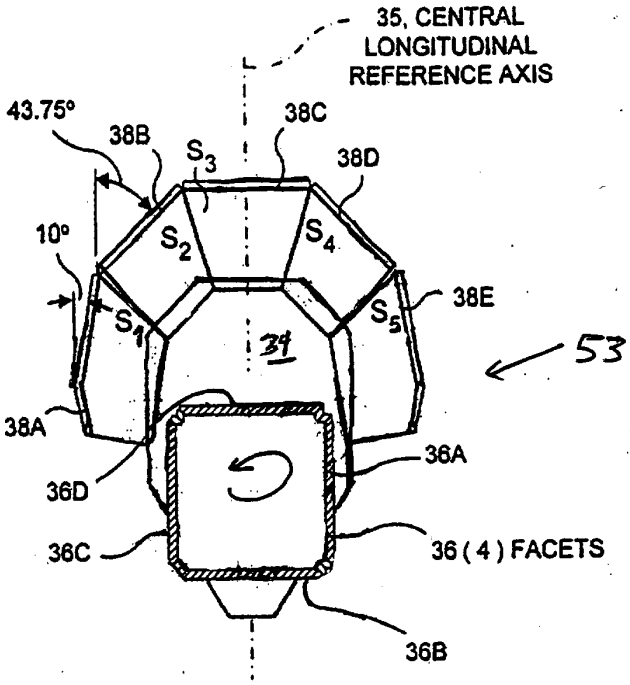
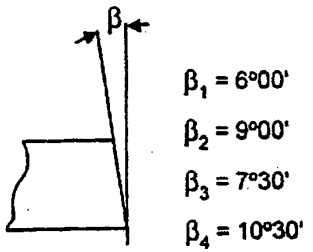


FIG. 4A

	TWIST α	BEND θ
S_{1-5}	10°	46.0°
S_{2-4}	43.75°	42.5°
S_3	90°	40.5°

FIG. 5B



$\beta_1 = 6°00'$
$\beta_2 = 9°00'$
$\beta_3 = 7°30'$
$\beta_4 = 10°30'$

FIG. 5A

th/o

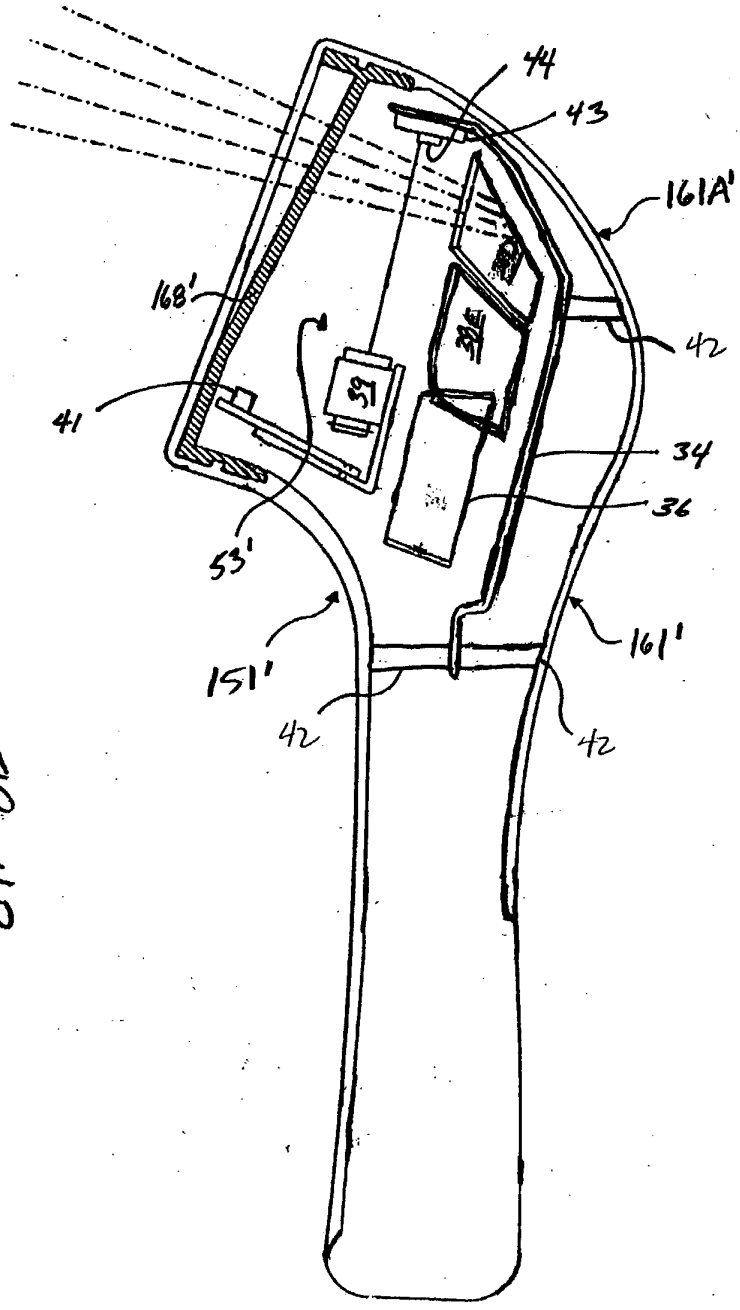


Fig. 4B

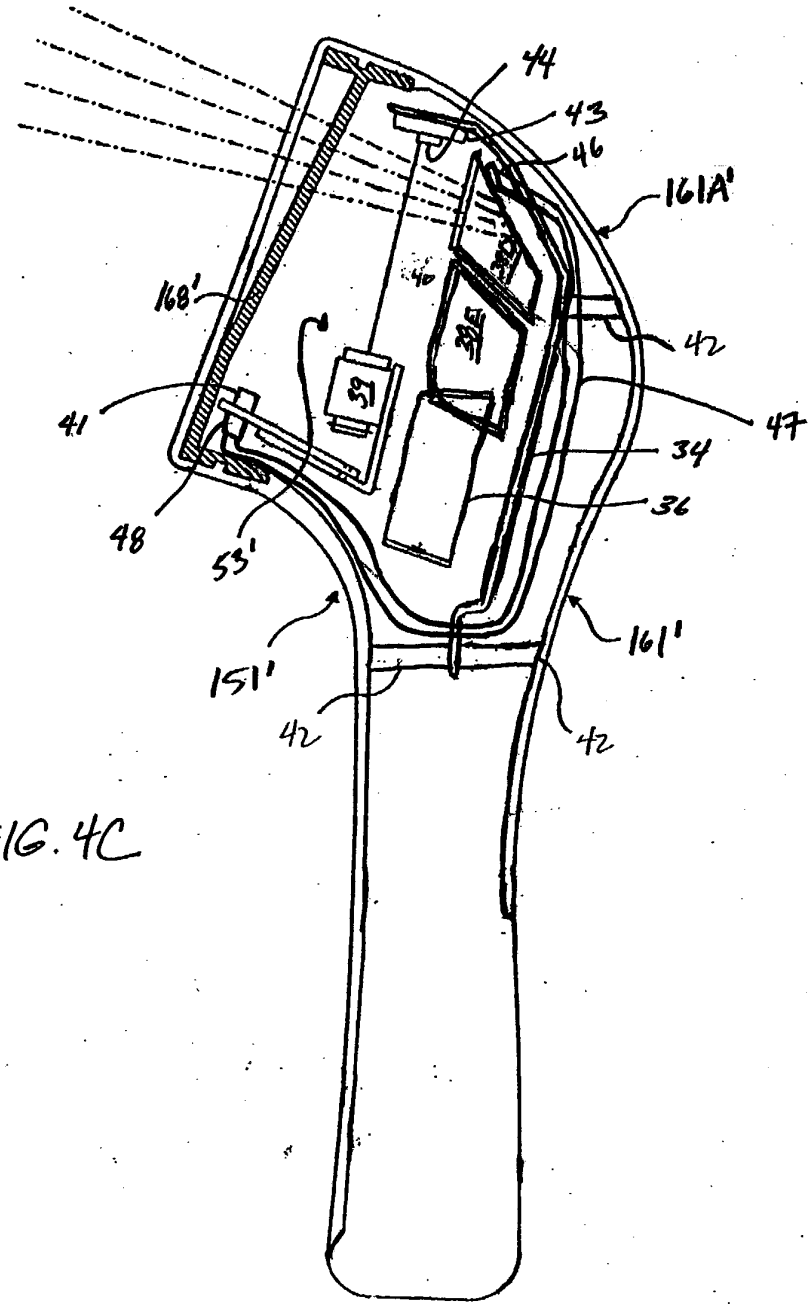


FIG. 4C

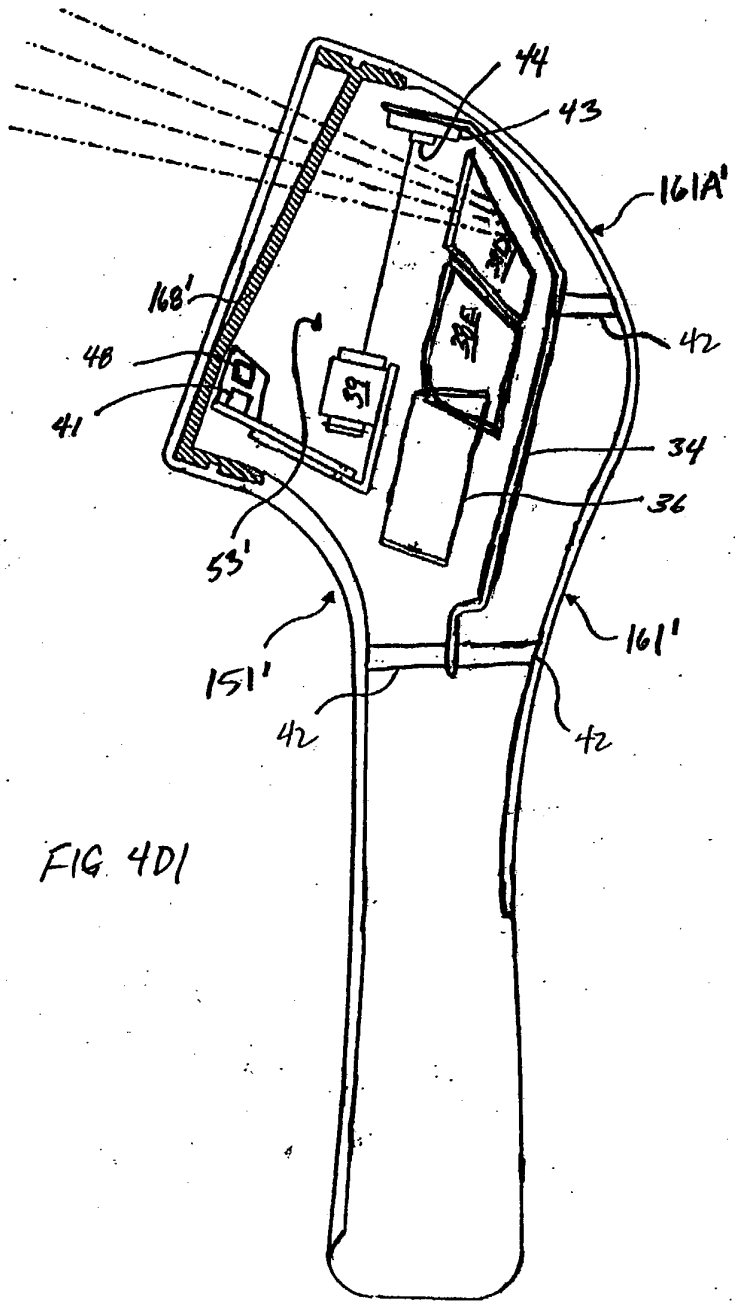


FIG. 4D1

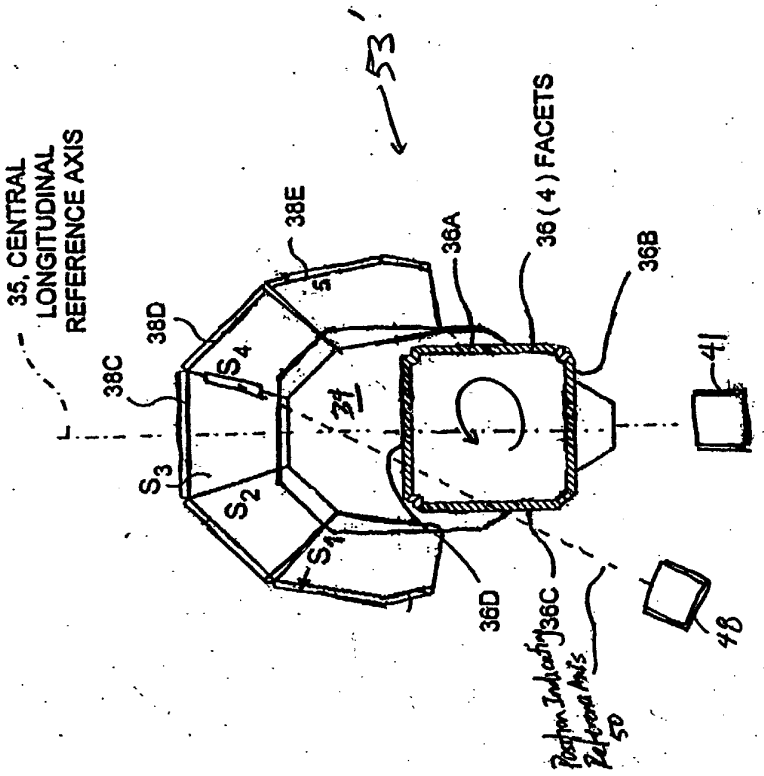

35, CENTRAL LONGITUDINAL REFERENCE AXIS
38C
38D
38E
36A
36 (4) FACETS
36B
41
53
S_3
S_2
S_1
S_4
31
36D
36C
48
Position Indicating Reference Axis
50

FIG. 4D2

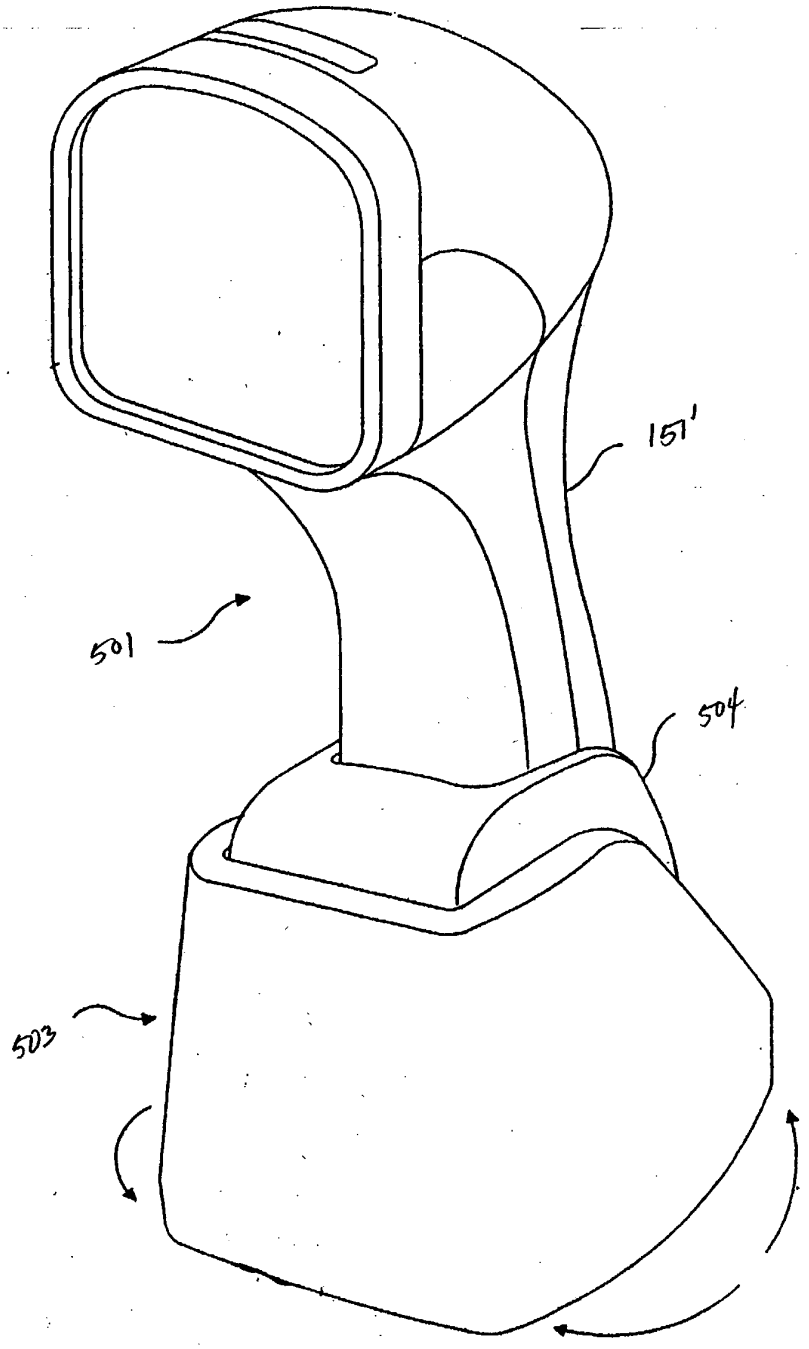


FIG. 5A

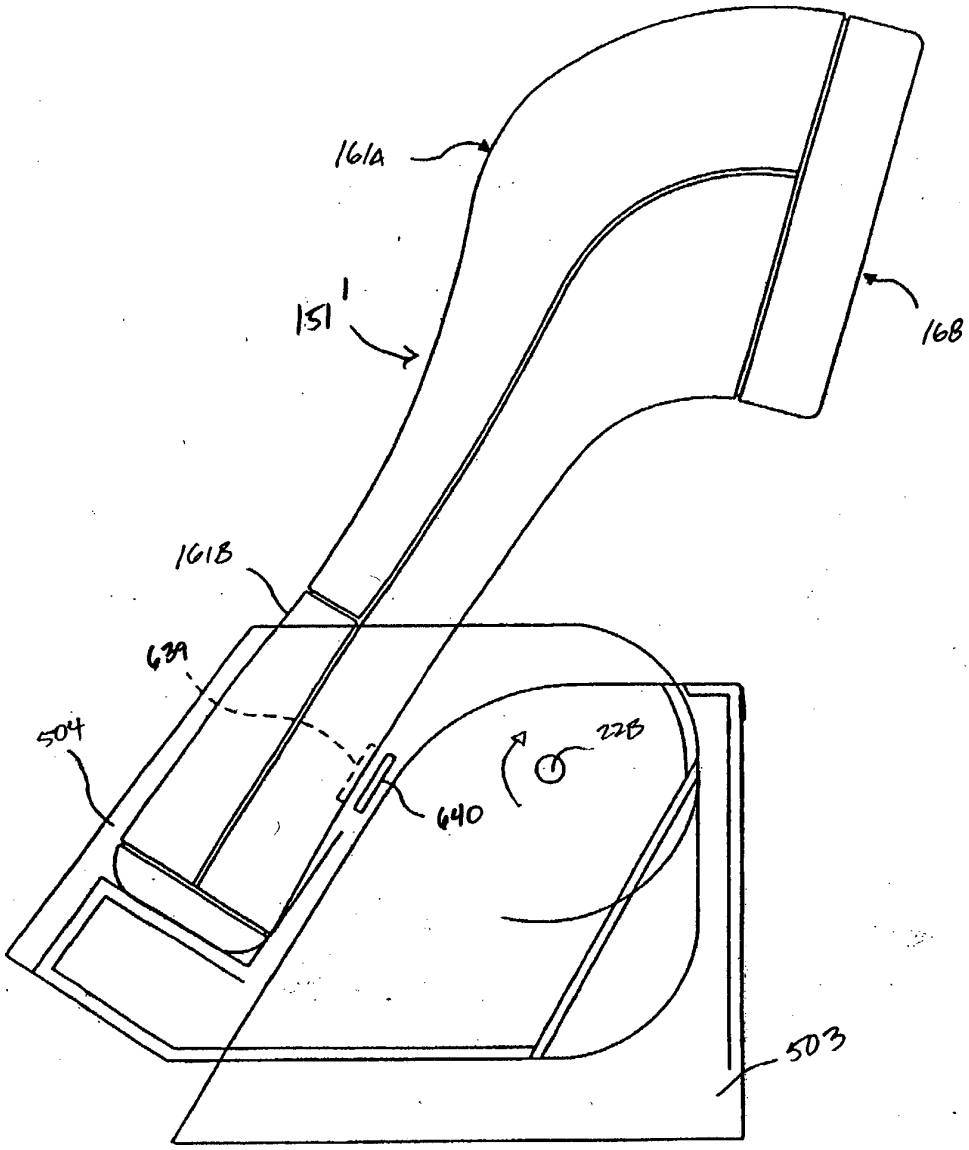


FIG. 5B

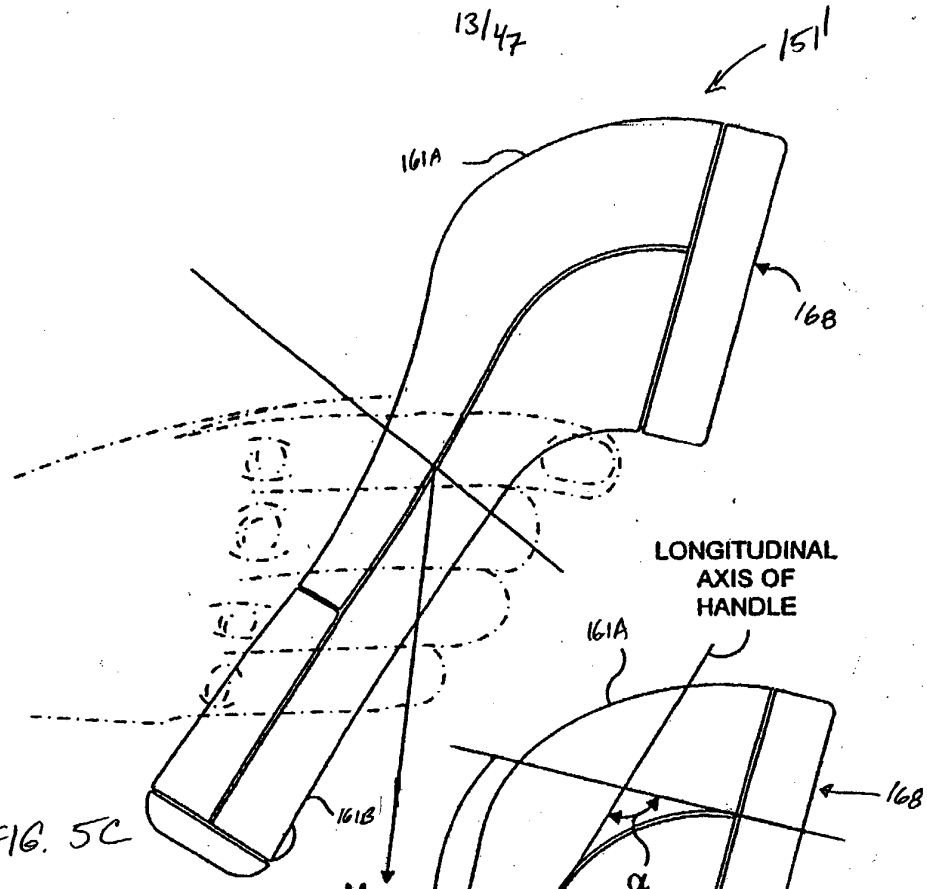

151'
161A
168
LONGITUDINAL AXIS OF HANDLE
161A
168
161B
M_C
α
AXIS OF HEAD SECTION; PARALLEL TO SCAN VOLUME PROJECTION AXIS
151'
161B

FIG. 5C

FIG. 5D

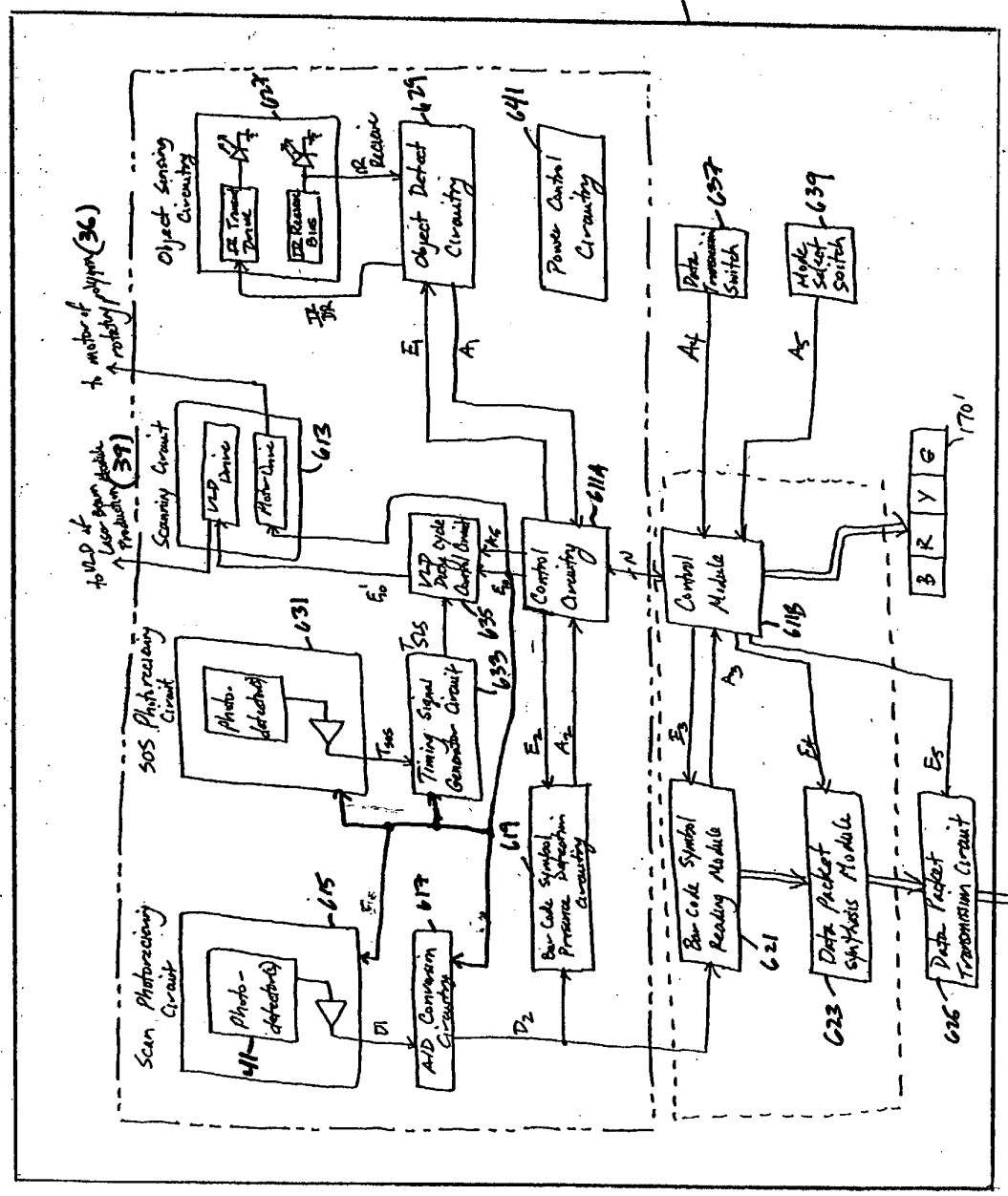

151'
Object Sensing Circuitry
IR Transmit Drive
IR Receive Bias
IR Transmit
IR Receive
Object Detect Circuitry
Power Control Circuitry
Data Transmission Switch
Mode Select Switch
Scanning Circuit
VSD Drive
Photo-Detector
Motor of Rotating Polygon (36)
Laser Beam Source Modulation (39)
SOS Photosensing Circuit
Photo-detector
Timing Signal Generator Circuit
VSD Duty Cycle Control Circuit
Control Circuitry
Control Module
Scan Photosensing Circuit
Photo-detector
A/D Conversion Circuitry
Bar Code Symbol Presence Detection Circuitry
Bar Code Symbol Reading Module
Data Packet Synthesis Module
Data Packet Transmission Circuit
Base Unit
Host Device
B
K
Y
G

FIG. 6

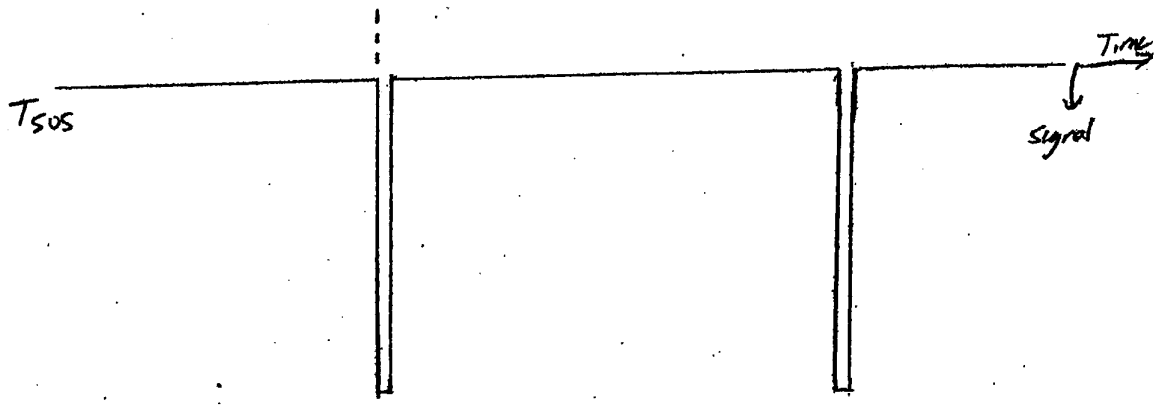


FIG. 7A

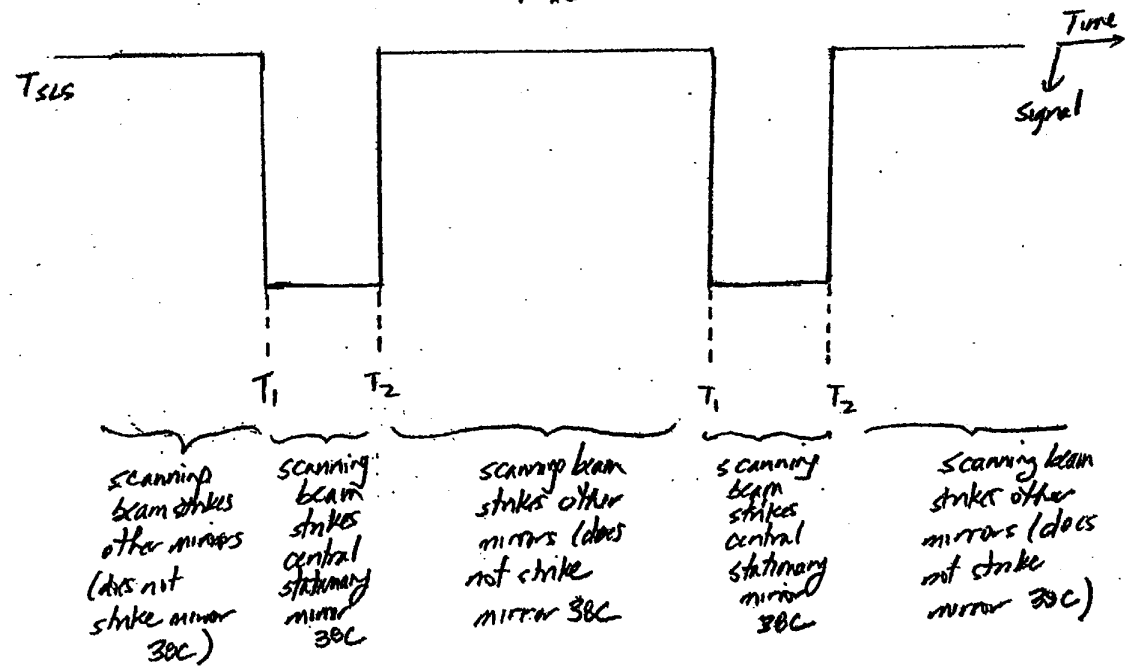


FIG. 7B

$$E_{10}' = (\overline{T_{SLS}} \cdot E_{10} \cdot A_5) + (E_{10} \cdot \overline{A_C})$$

FIG. 7C

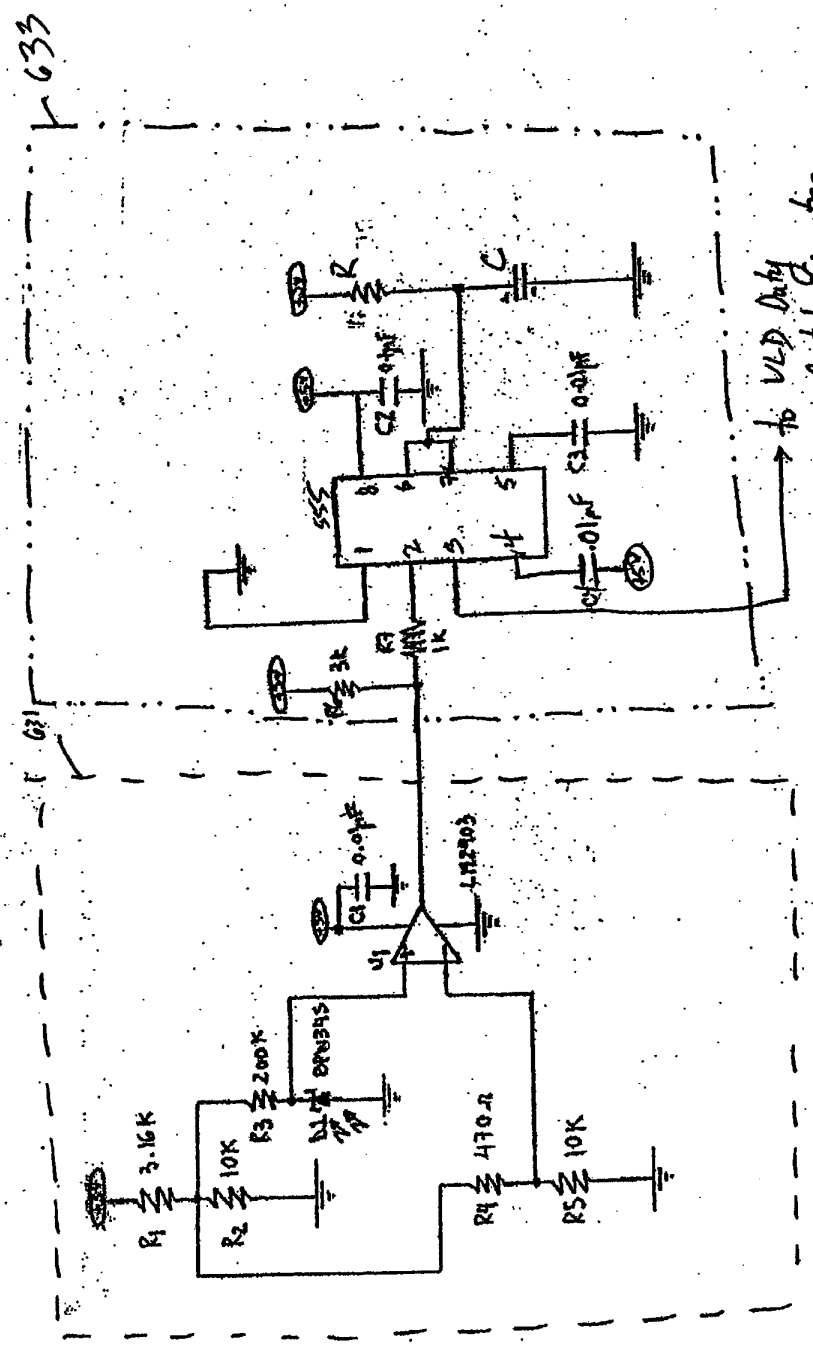
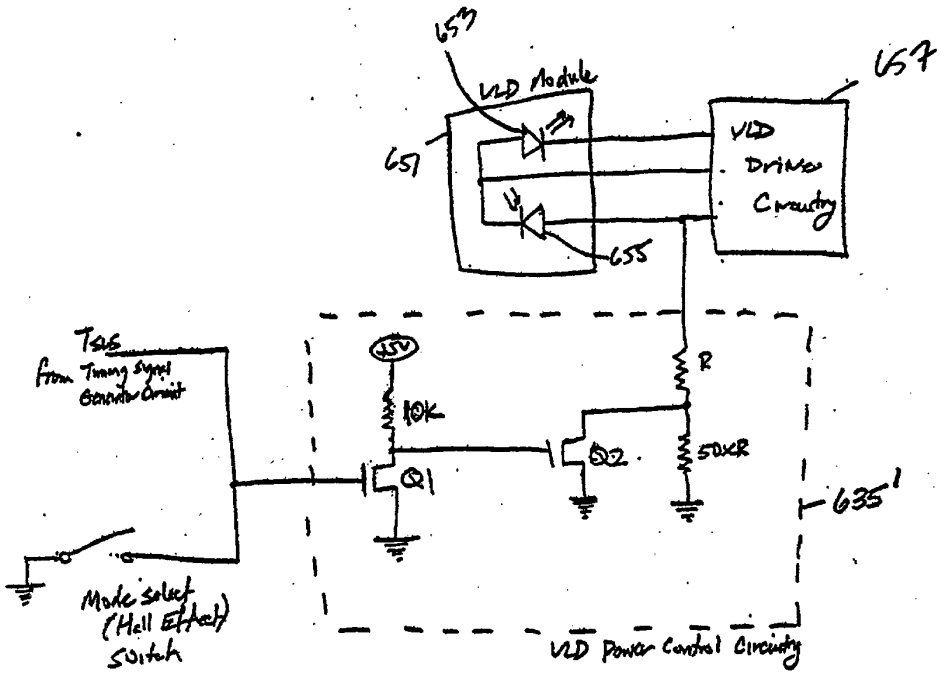

633
631
555
R
C
C2 0.1μF
C3 0.01μF
.01μF
1
2
3
4
5
8
7
6
R3 1K
3k
C1 0.01μF
LM2903
U1
200K
BRUSH
3.16K
10K
R1
R2
R3
R4 470Ω
R5 10K
to VLD Data Control Circuitry 635

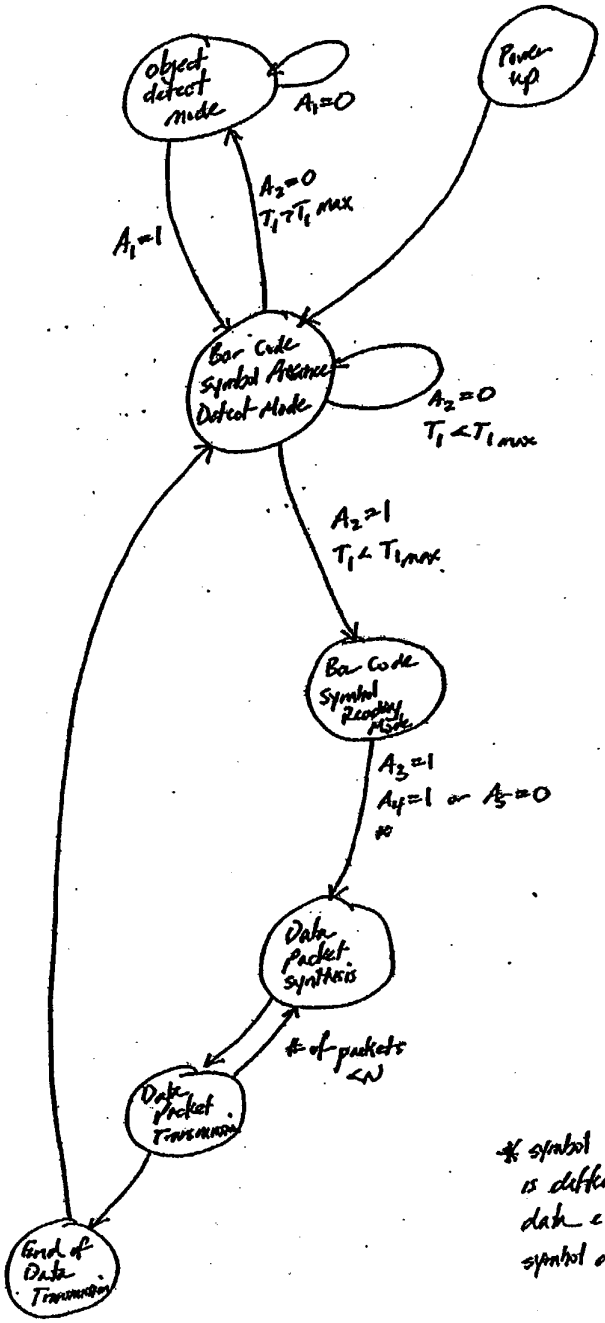
FIG. 7D



Mode Select	T_{SLS}	Q1	Q2	R_{EFF}	P_{LASER}
Open	H	ON	OFF	~51R_{SET}	Low
Open	L	OFF	ON	~R_{SET}	Normal
Closed	X	OFF	ON	~R_{SET}	Normal

FIG. 7E

10,095,765 - 11/13/2018



* symbol character data is different than data element in decoded symbol data buffer

FIG. 8

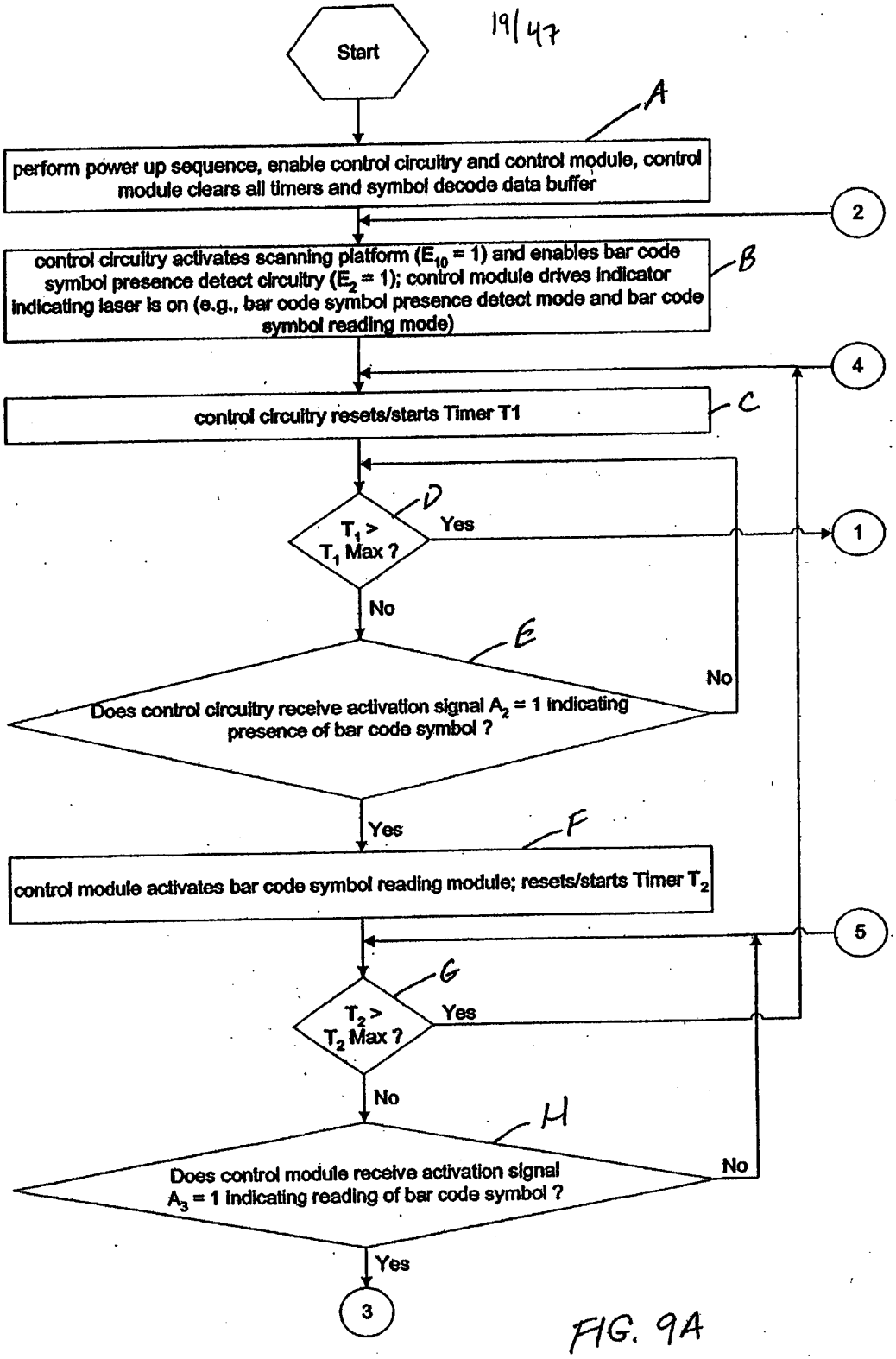

Start
A
perform power up sequence, enable control circuitry and control module, control module clears all timers and symbol decode data buffer
2
control circuitry activates scanning platform (E_{10} = 1) and enables bar code symbol presence detect circuitry (E_2 = 1); control module drives indicator indicating laser is on (e.g., bar code symbol presence detect mode and bar code symbol reading mode)
B
4
control circuitry resets/starts Timer T1
C
D
T_1 > T_1 Max ?
Yes
1
No
E
No
Does control circuitry receive activation signal A_2 = 1 indicating presence of bar code symbol ?
Yes
F
control module activates bar code symbol reading module; resets/starts Timer T_2
5
G
T_2 > T_2 Max ?
Yes
No
H
No
Does control module receive activation signal A_3 = 1 indicating reading of bar code symbol ?
Yes
3

FIG. 9A

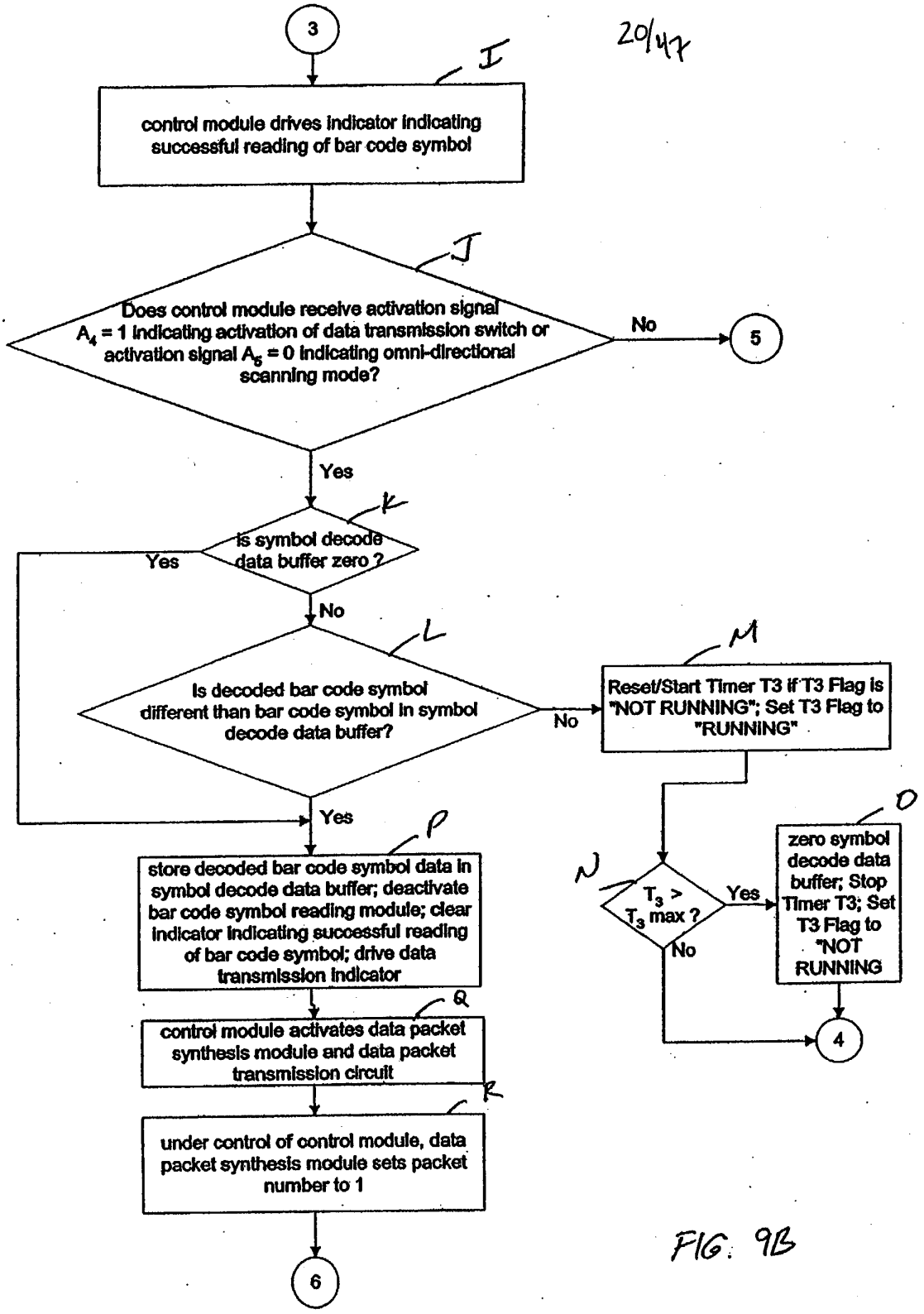

3
I
control module drives indicator indicating successful reading of bar code symbol
J
Does control module receive activation signal A_4 = 1 indicating activation of data transmission switch or activation signal A_5 = 0 indicating omni-directional scanning mode?
No
5
Yes
K
Is symbol decode data buffer zero ?
Yes
No
L
Is decoded bar code symbol different than bar code symbol in symbol decode data buffer?
No
M
Reset/Start Timer T3 if T3 Flag is "NOT RUNNING"; Set T3 Flag to "RUNNING"
Yes
P
store decoded bar code symbol data in symbol decode data buffer; deactivate bar code symbol reading module; clear indicator indicating successful reading of bar code symbol; drive data transmission indicator
Q
control module activates data packet synthesis module and data packet transmission circuit
R
under control of control module, data packet synthesis module sets packet number to 1
6
N
T_3 > T_3 max ?
Yes
No
O
zero symbol decode data buffer; Stop Timer T3; Set T3 Flag to "NOT RUNNING
4

FIG. 9B

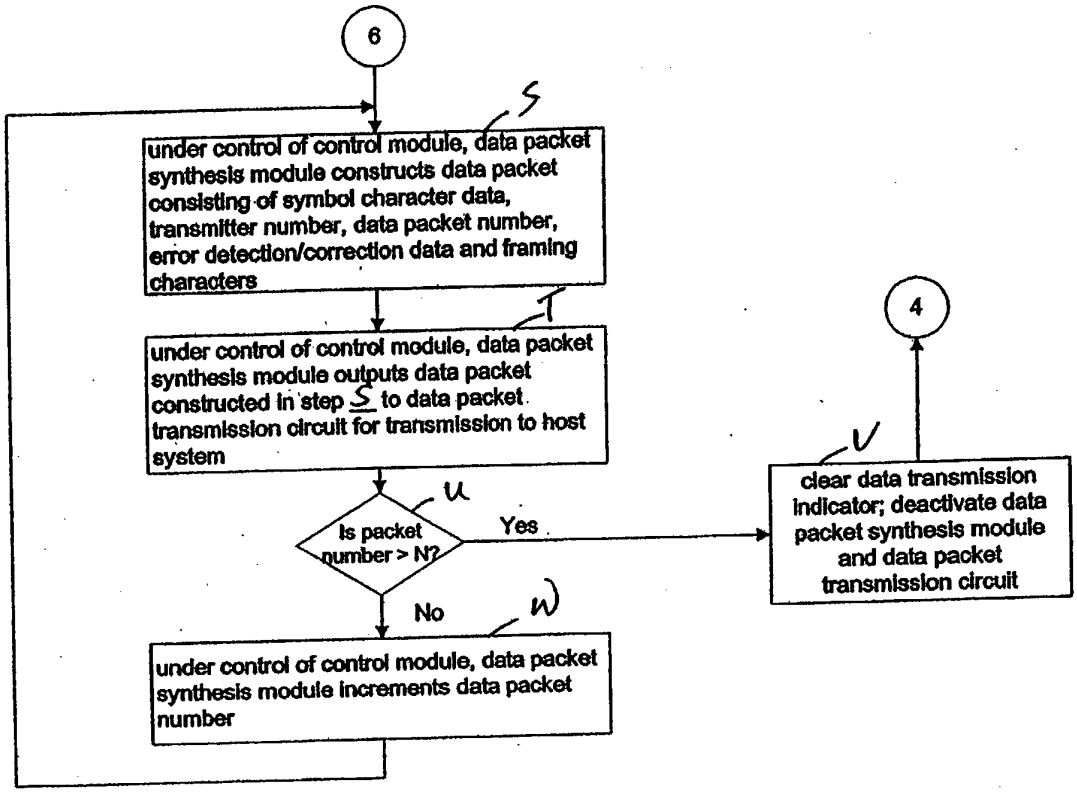

6
S
under control of control module, data packet synthesis module constructs data packet consisting of symbol character data, transmitter number, data packet number, error detection/correction data and framing characters
T
under control of control module, data packet synthesis module outputs data packet constructed in step S to data packet transmission circuit for transmission to host system
U
Is packet number > N?
Yes
No
V
clear data transmission indicator; deactivate data packet synthesis module and data packet transmission circuit
4
W
under control of control module, data packet synthesis module increments data packet number

FIG. 9C

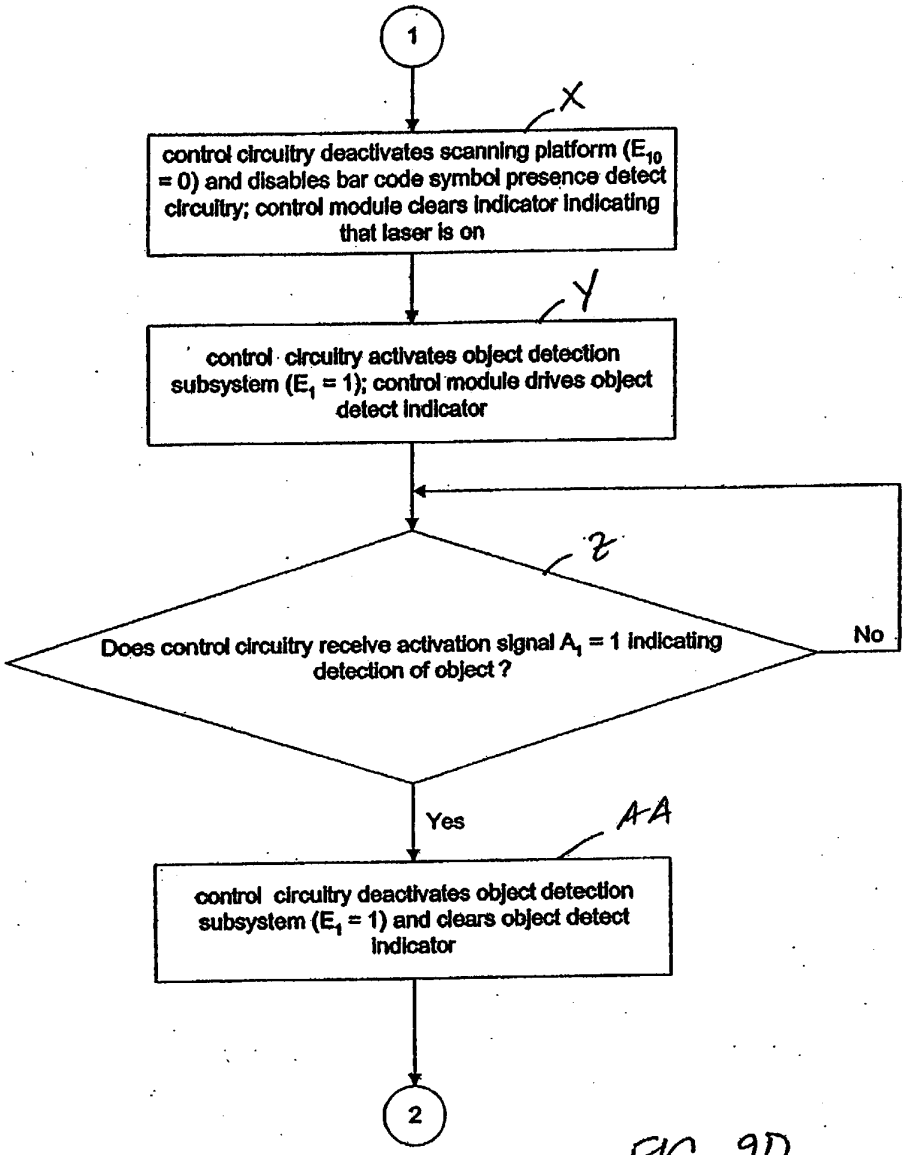

1
X
control circuitry deactivates scanning platform (E_{10} = 0) and disables bar code symbol presence detect circuitry; control module clears indicator indicating that laser is on
Y
control circuitry activates object detection subsystem (E_1 = 1); control module drives object detect indicator
Z
Does control circuitry receive activation signal A_1 = 1 indicating detection of object ?
No
Yes
AA
control circuitry deactivates object detection subsystem (E_1 = 1) and clears object detect indicator
2

FIG. 9D

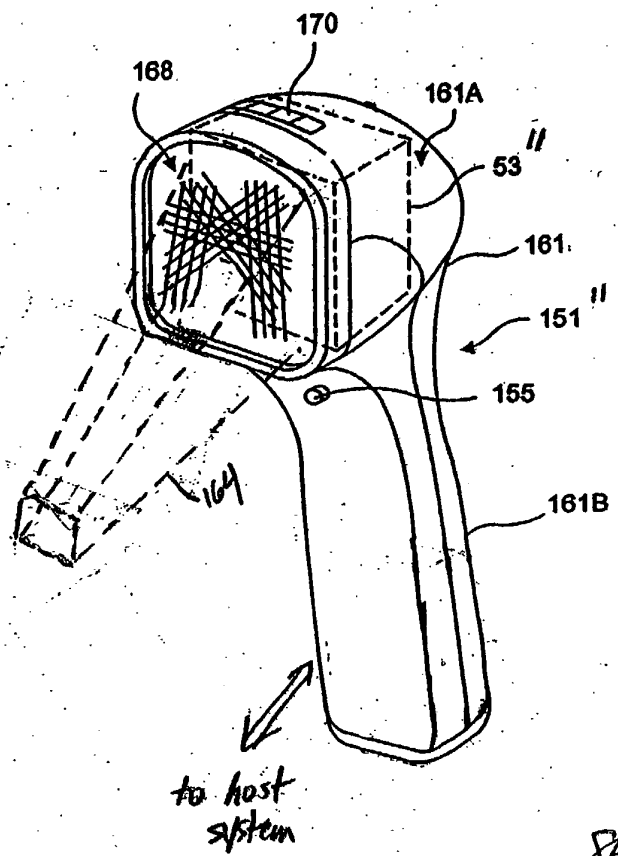


FIG. 10A

Second Generalized Embodiment

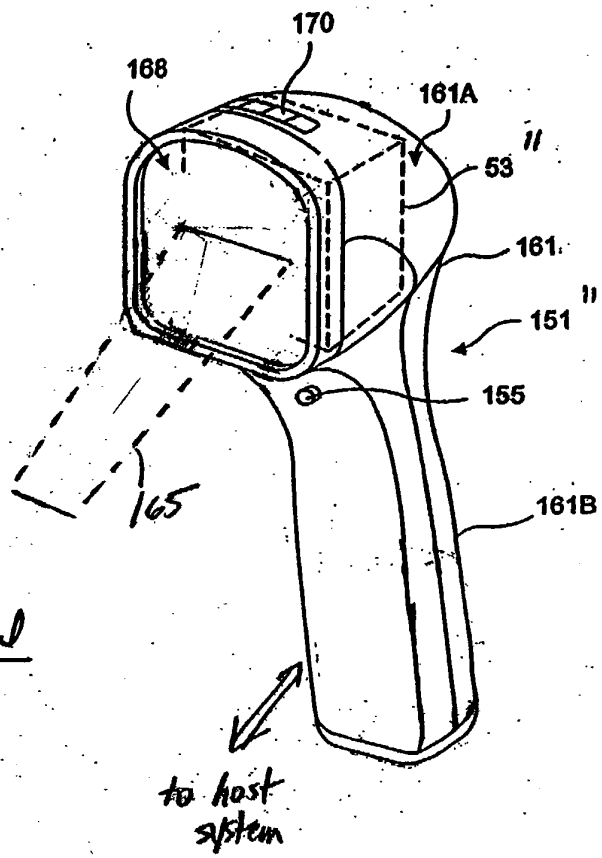

170
168
161A
53
161
151
155
165
161B
Uni-directional Scanning mode
to host system

FIG. 10B

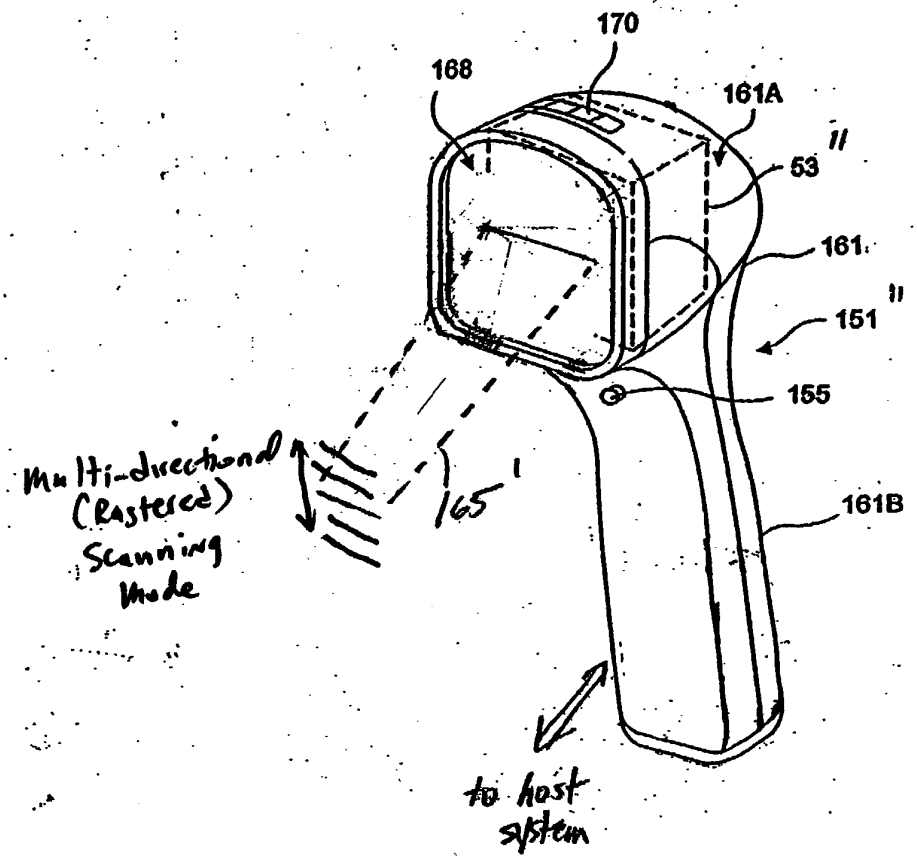

170
168
161A
53
161
151
155
Multi-directional (Rastered) Scanning Mode
165
161B
to host system

FIG. 10C

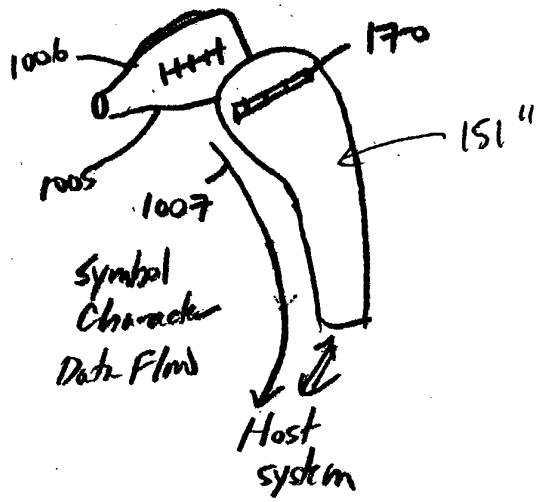
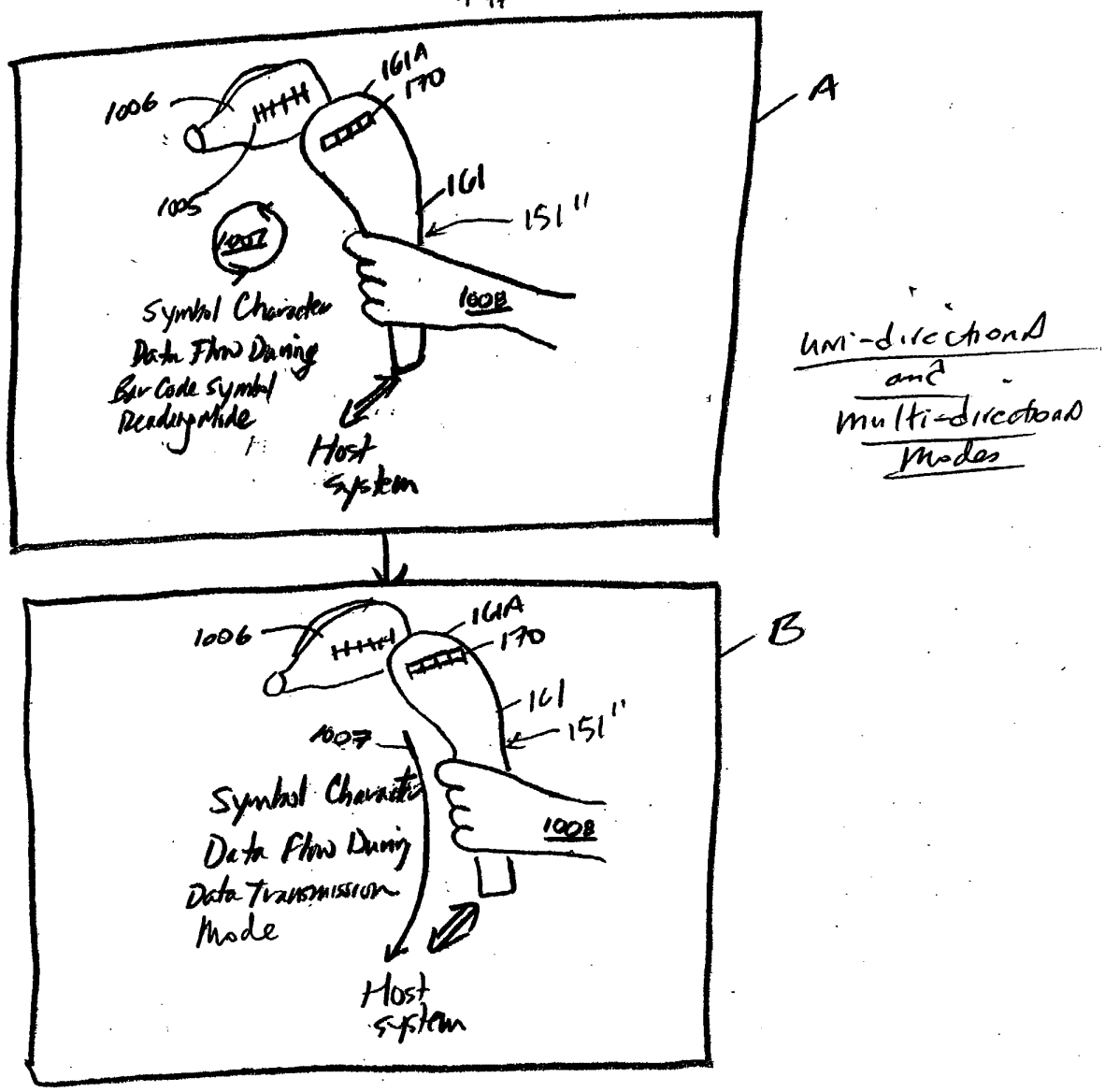

1006
170
151"
1005
1007
Symbol Character Data Flow
Host system

FIG. 11A



Uni-directional and Multi-directional Modes

FIG. 11B

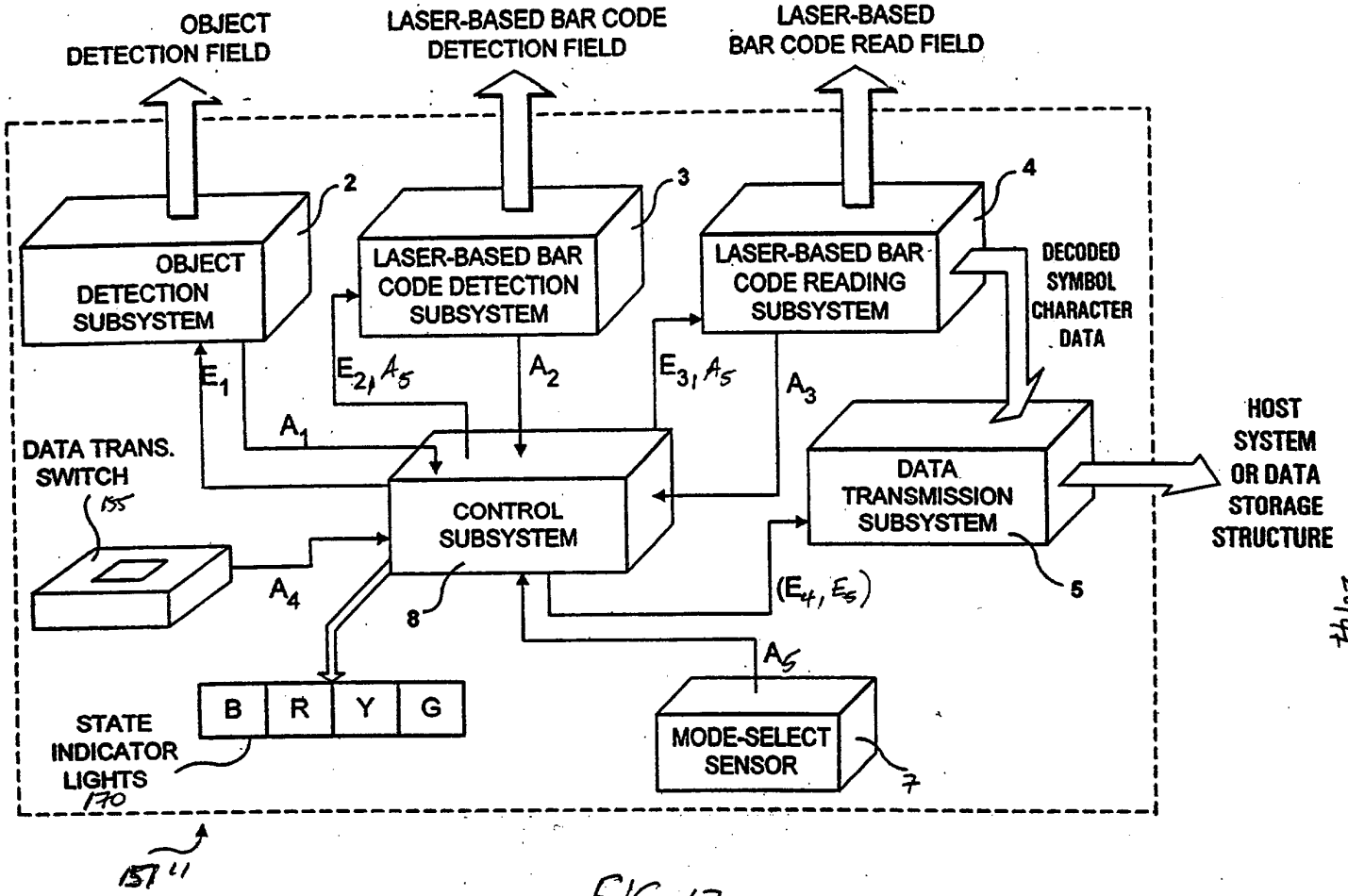

OBJECT DETECTION FIELD
LASER-BASED BAR CODE DETECTION FIELD
LASER-BASED BAR CODE READ FIELD
OBJECT DETECTION SUBSYSTEM
2
LASER-BASED BAR CODE DETECTION SUBSYSTEM
3
LASER-BASED BAR CODE READING SUBSYSTEM
4
DECODED SYMBOL CHARACTER DATA
E_1
A_1
E_2, A_5
A_2
E_3, A_5
A_3
DATA TRANS. SWITCH
155
CONTROL SUBSYSTEM
DATA TRANSMISSION SUBSYSTEM
5
HOST SYSTEM OR DATA STORAGE STRUCTURE
A_4
8
(E_4, E_5)
A_5
B
R
Y
G
STATE INDICATOR LIGHTS
170
MODE-SELECT SENSOR
7
157
11

FIG. 12

28/44

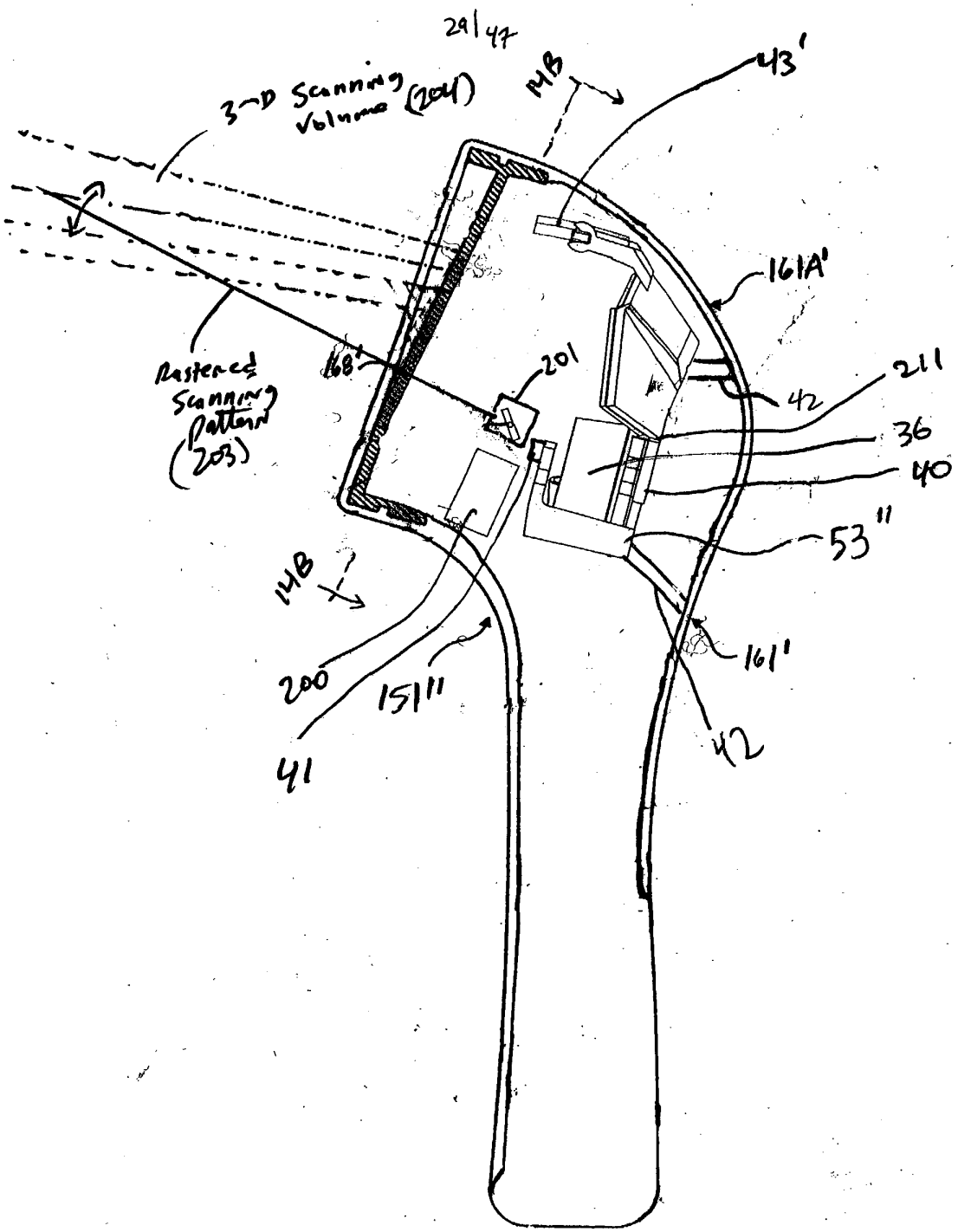

29/47
3-D Scanning Volume (204)
14B
43'
161A'
Rastered Scanning Pattern (203)
168'
201
211
42
36
40
53"
14B
200
151"
41
161'
42

FIG. 13

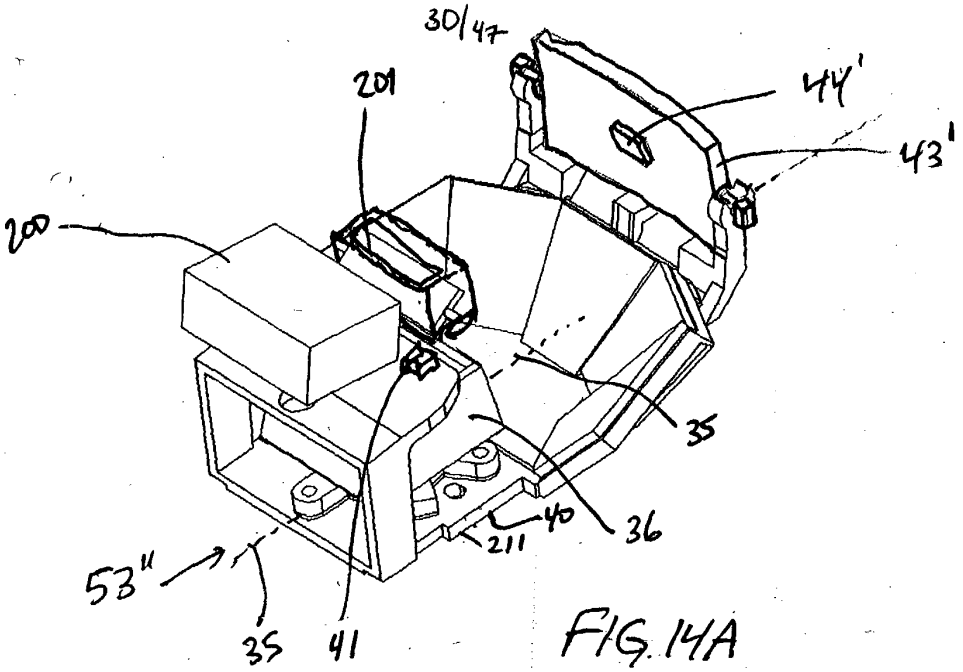


FIG. 14A

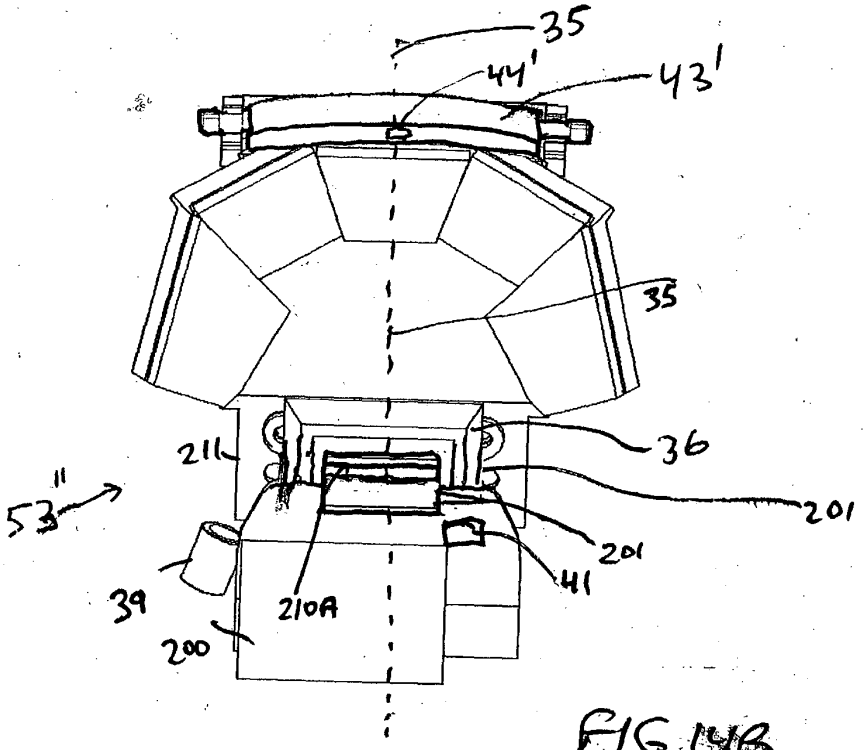


FIG 14B

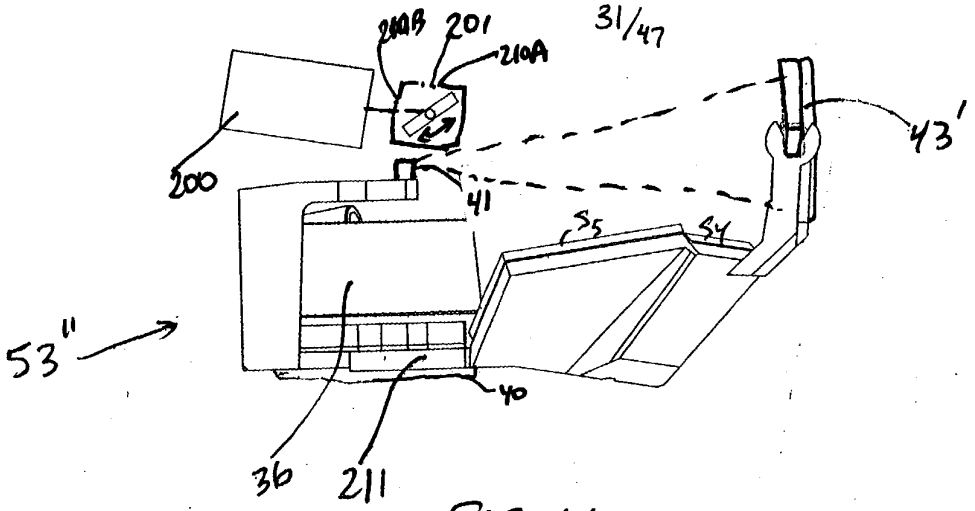


FIG. 14C

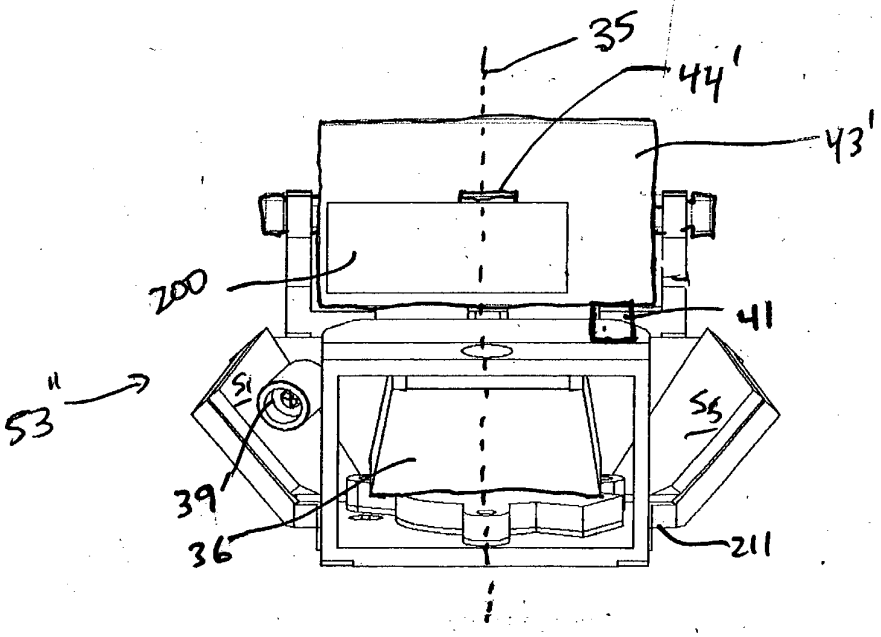


FIG. 14D

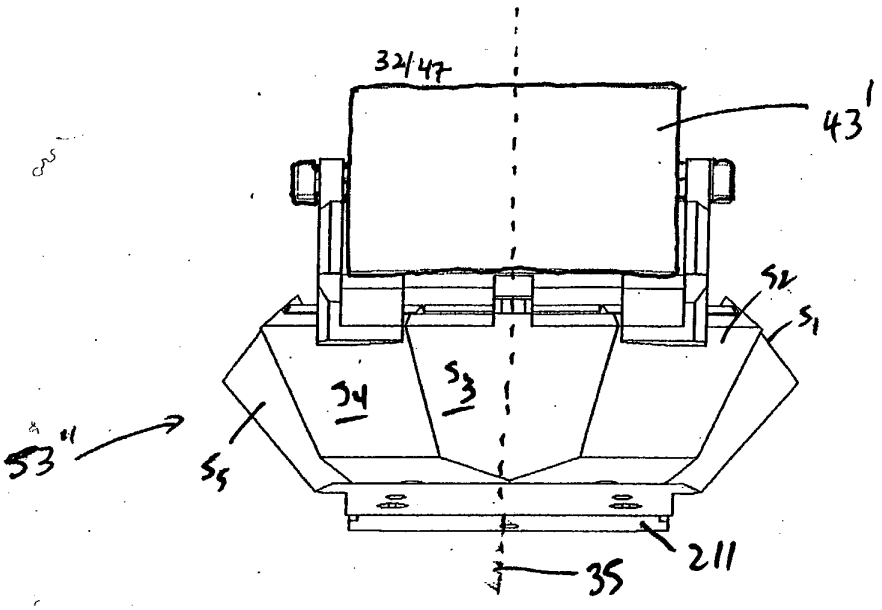


FIG. 14E

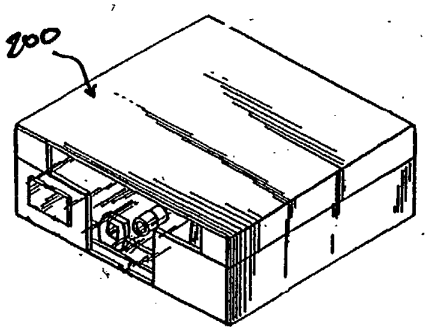


FIG. 14F

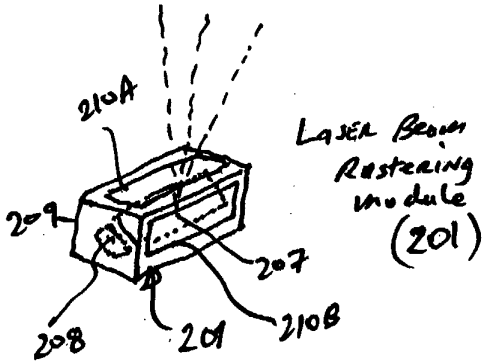


FIG. 14G

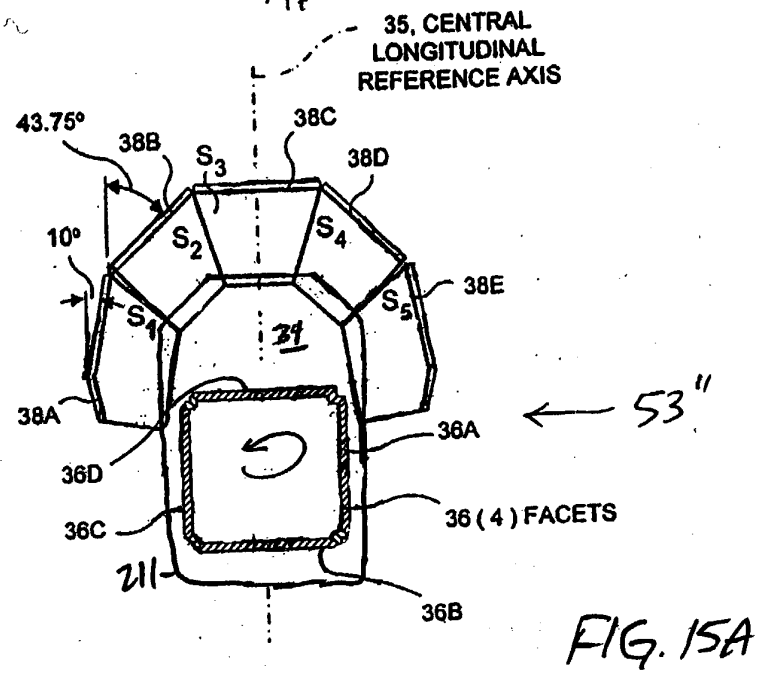


FIG. 15A

Optics Bench Array Mirror Specifications

Mirror	Relief Angle	Twist Angle
	Degrees	
1	45.91	69.32
2	47.85	34.15
3	48.4	0
4	47.85	34.15
5	45.91	69.32

Mirror	Length	Width
	Millimeters	
1	19.872	17.303
2	16.341	13.746
3	16.67	15.788
4	16.341	13.746
5	19.872	17.303

FIG. 15B

Angles specification:

Definitions:
Relief Angle - The angle between the plane including all the bottom front edges of the array mirrors and the front surface of the mirror being measured.
Twist Angle - The angle of rotation about the z-axis with 0 degrees twist being definied as perpendicular to the incident beam (field 3)

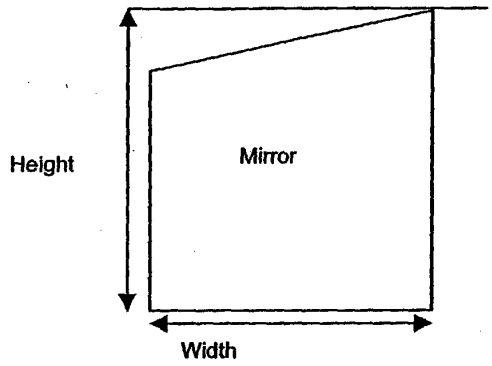


FIG. 15C

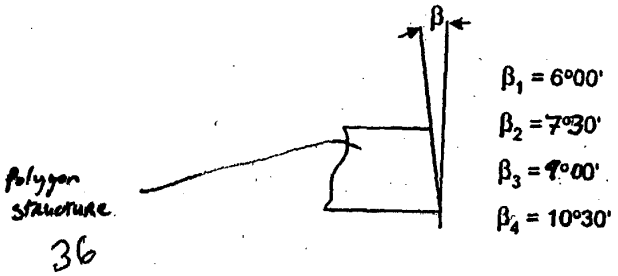


FIG. 15D

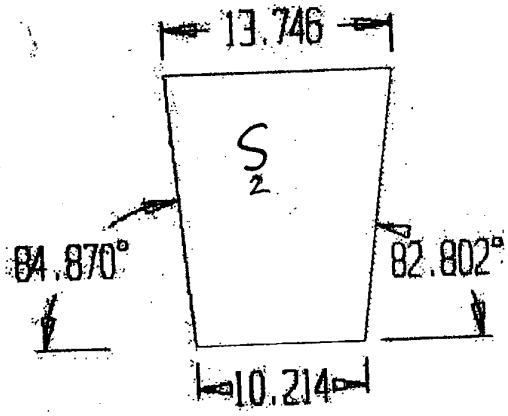


FIG. 15F

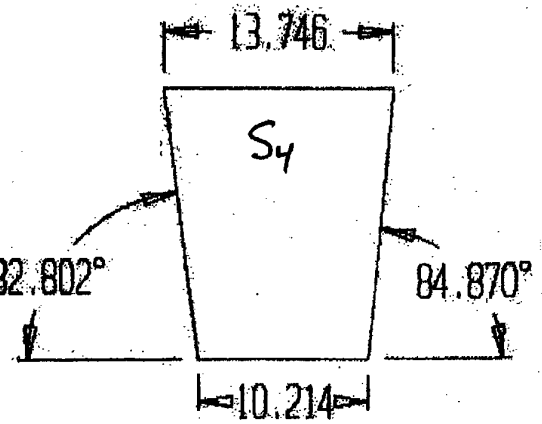


FIG. 15H

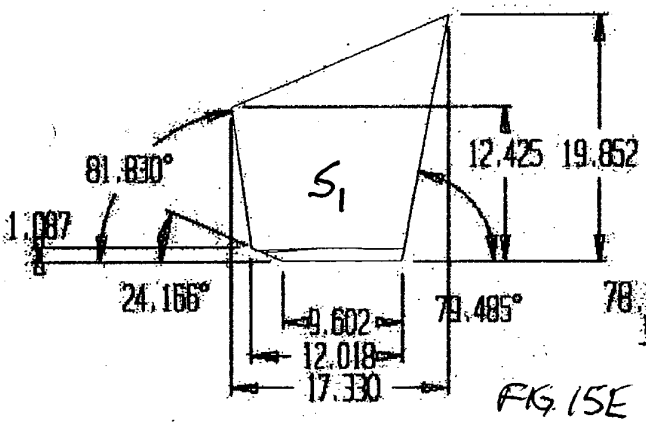


FIG. 15E

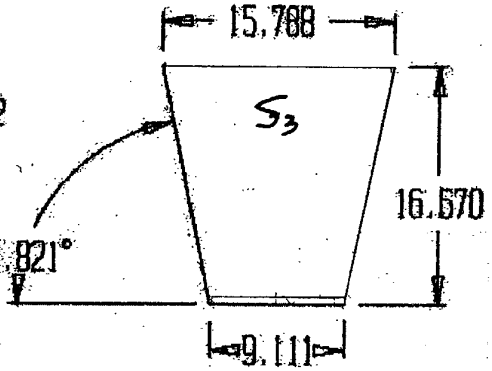


FIG. 15G

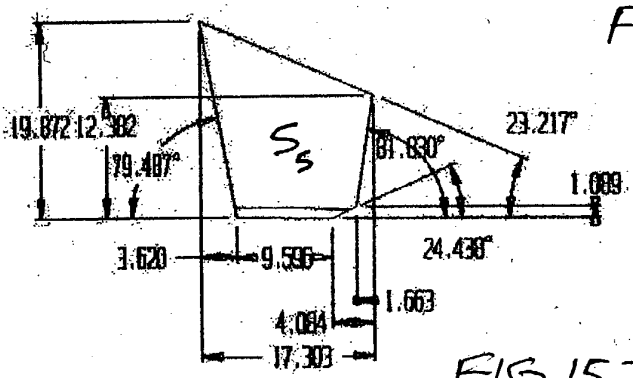


FIG. 15I

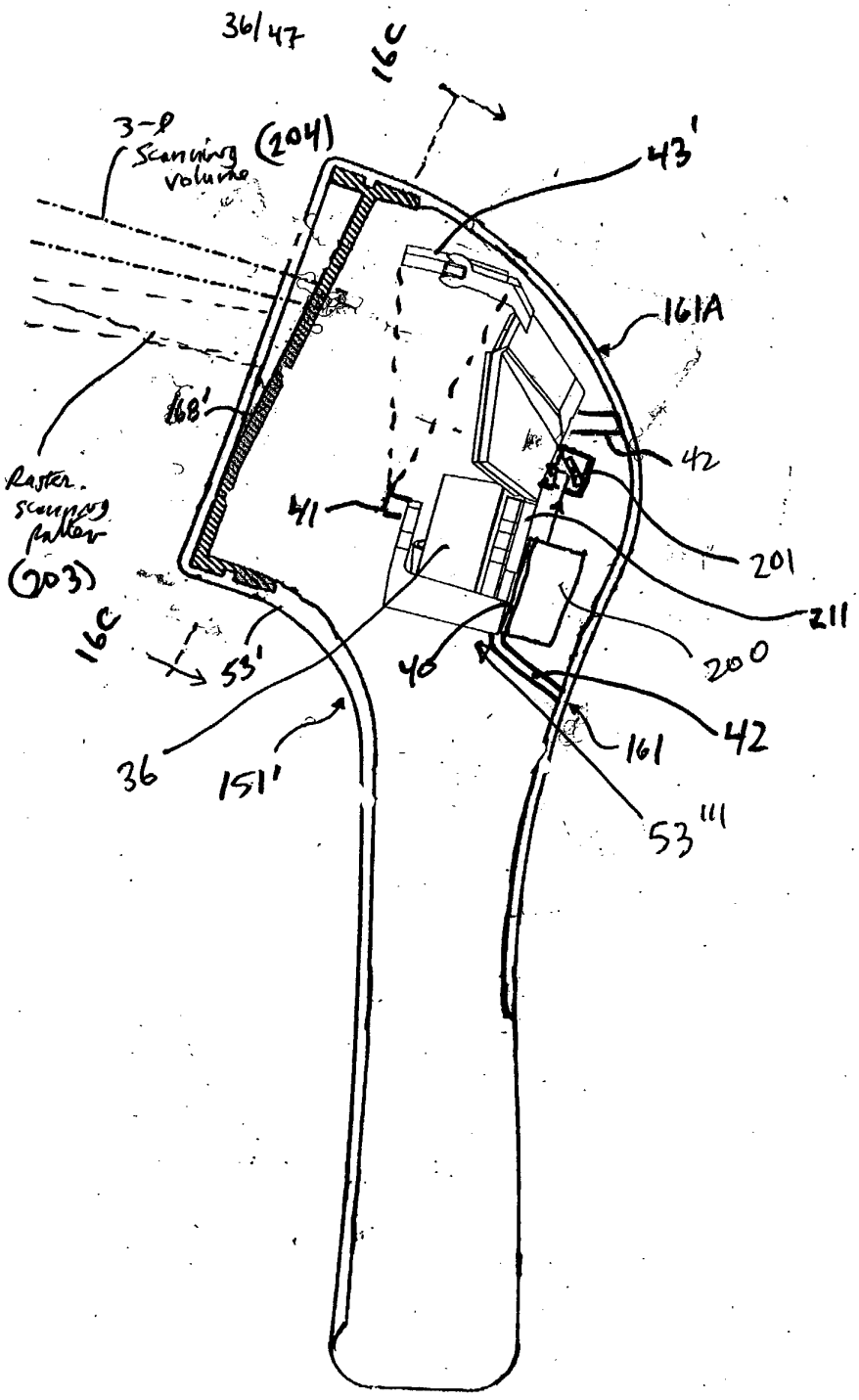

36/47
16C
3-D Scanning volume (204)
43'
161A
168'
42
41
Raster scanning pattern (203)
201
211
16C
53'
40
200
42
36
151'
161
53'''

FIG. 16A

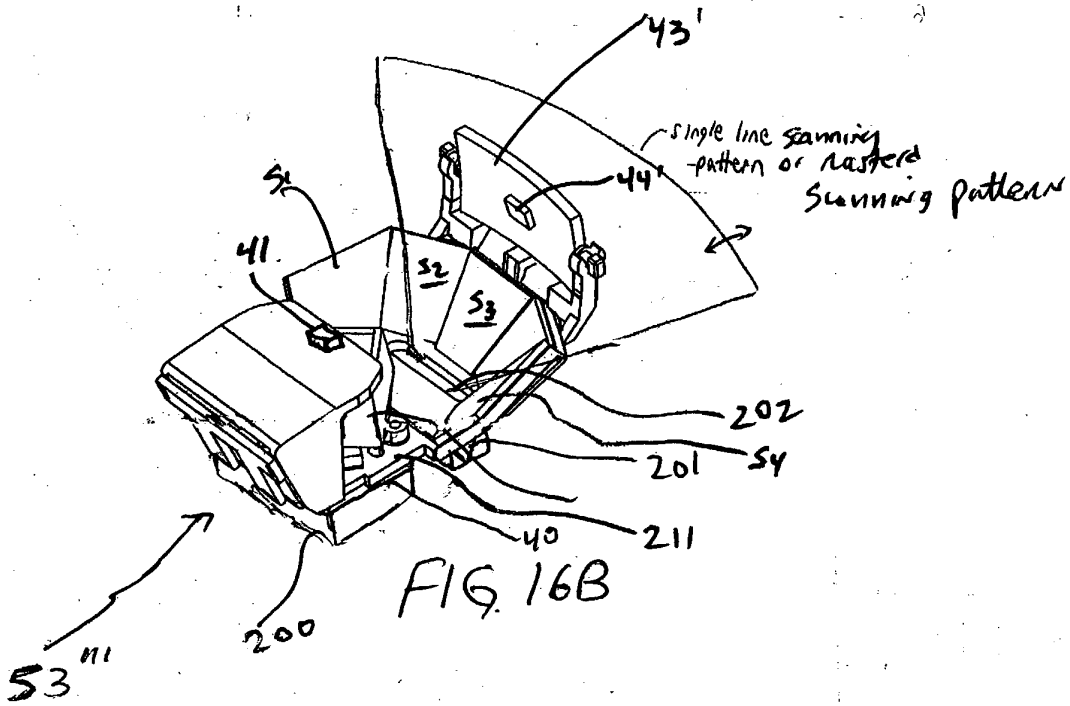


FIG. 16B

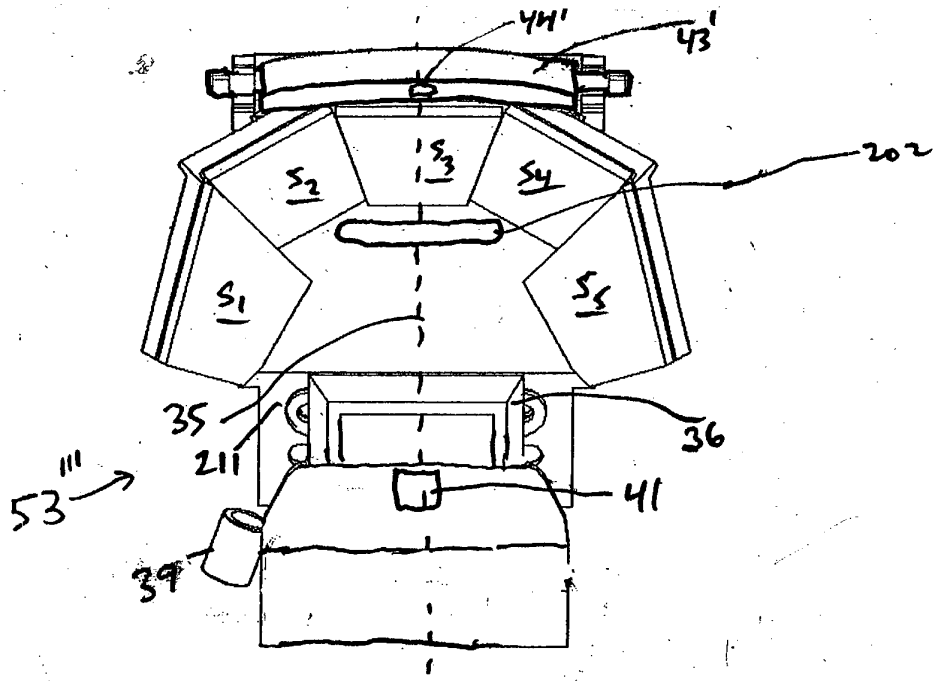


FIG. 16C

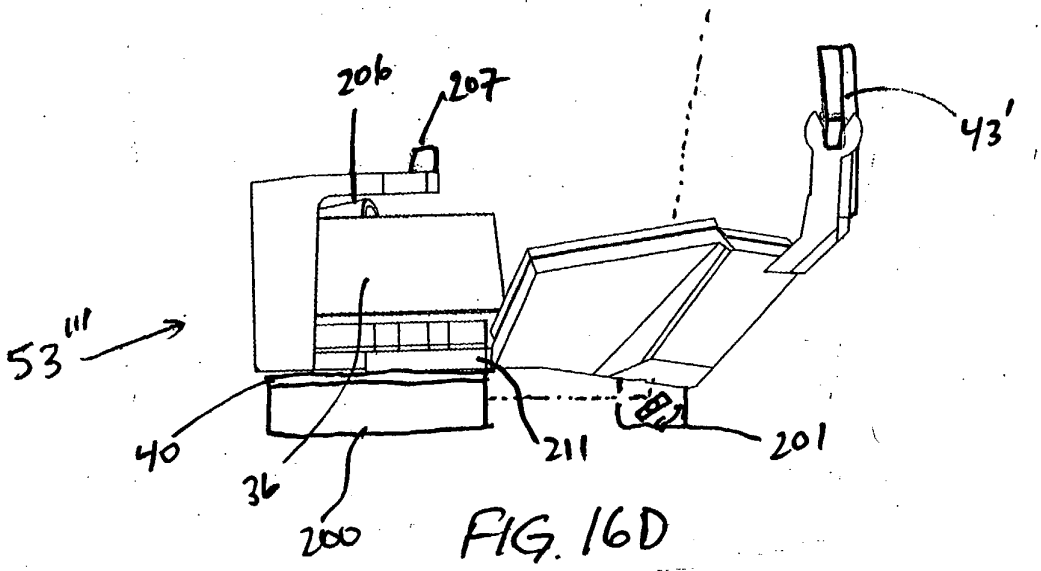


FIG. 16D

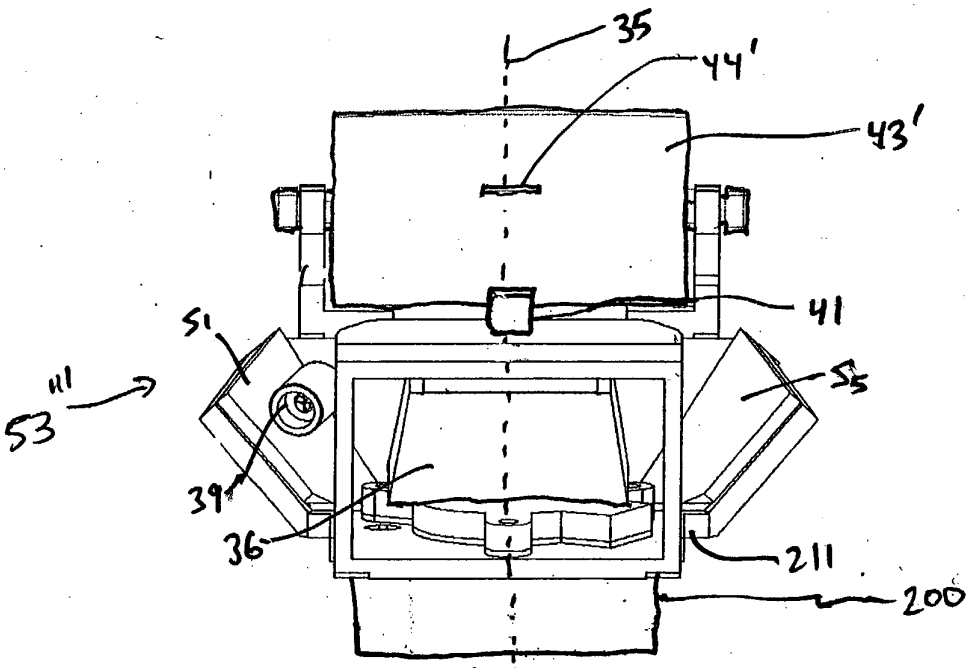


FIG. 16E

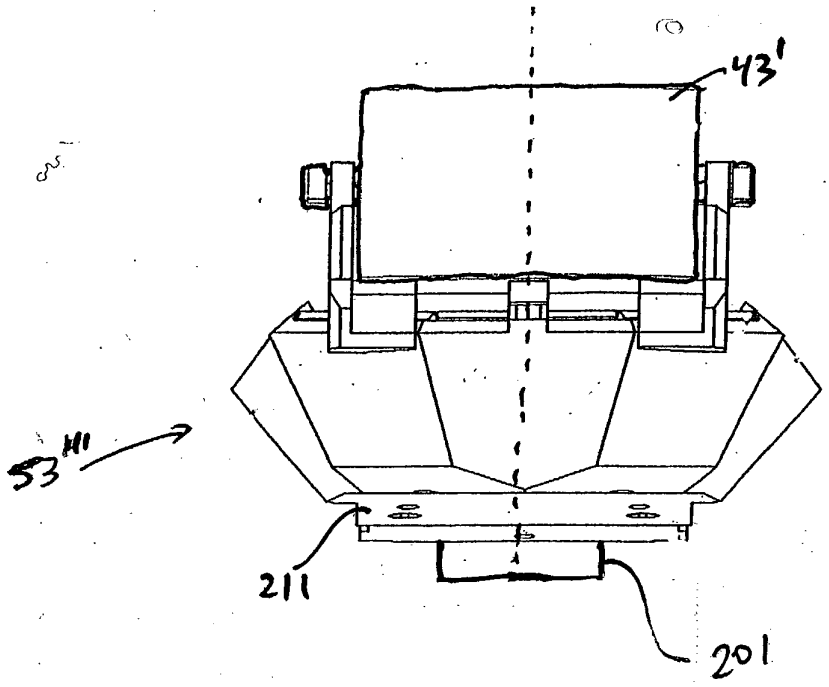


FIG. 16F

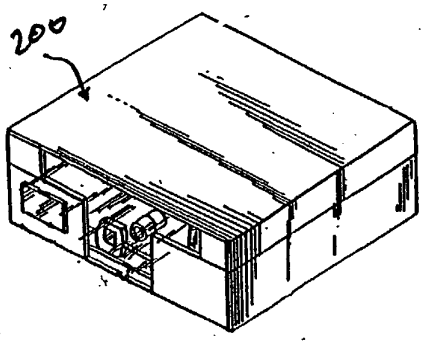


FIG 16G

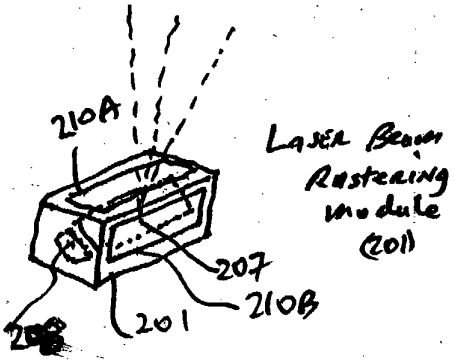


FIG 16H

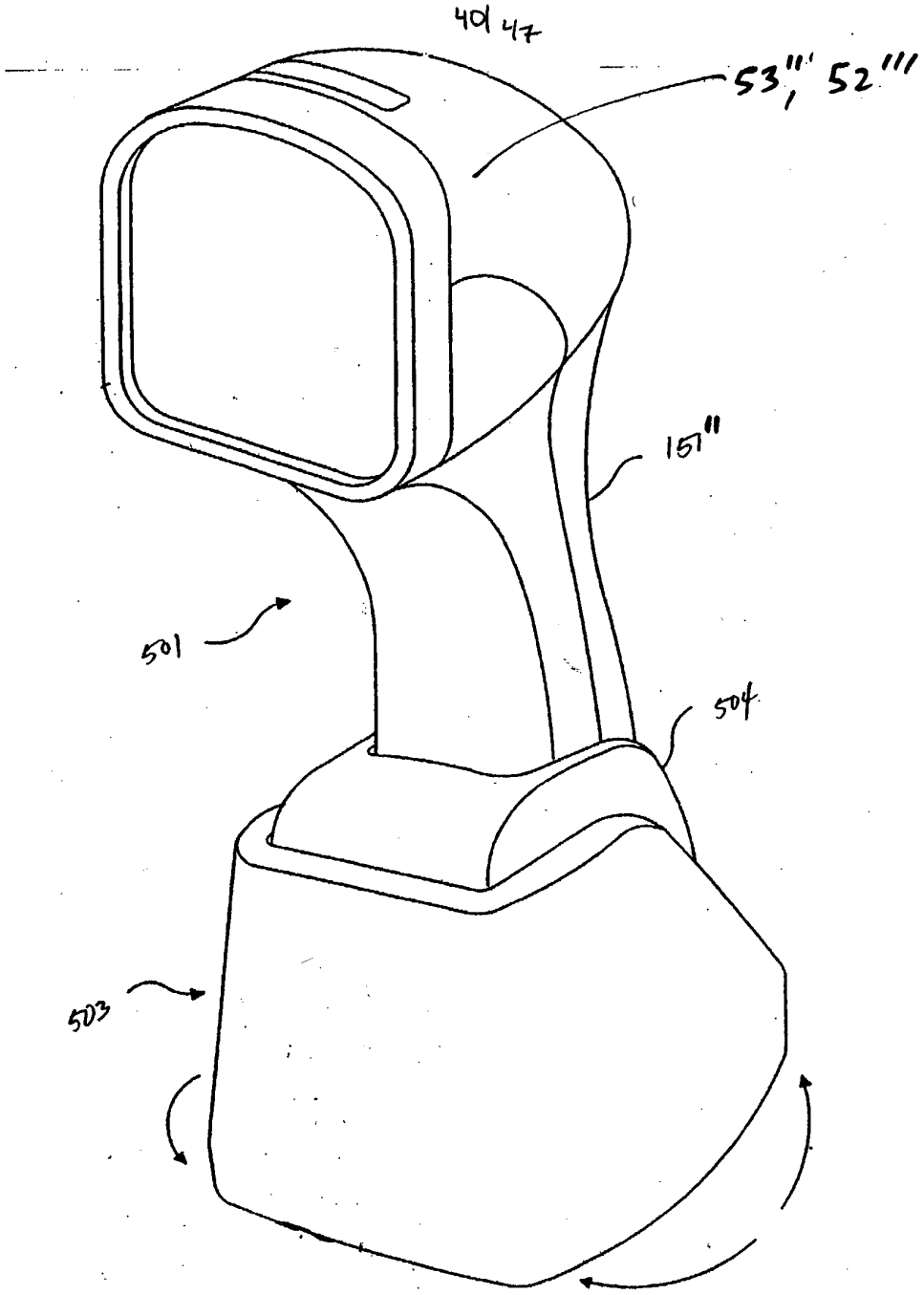
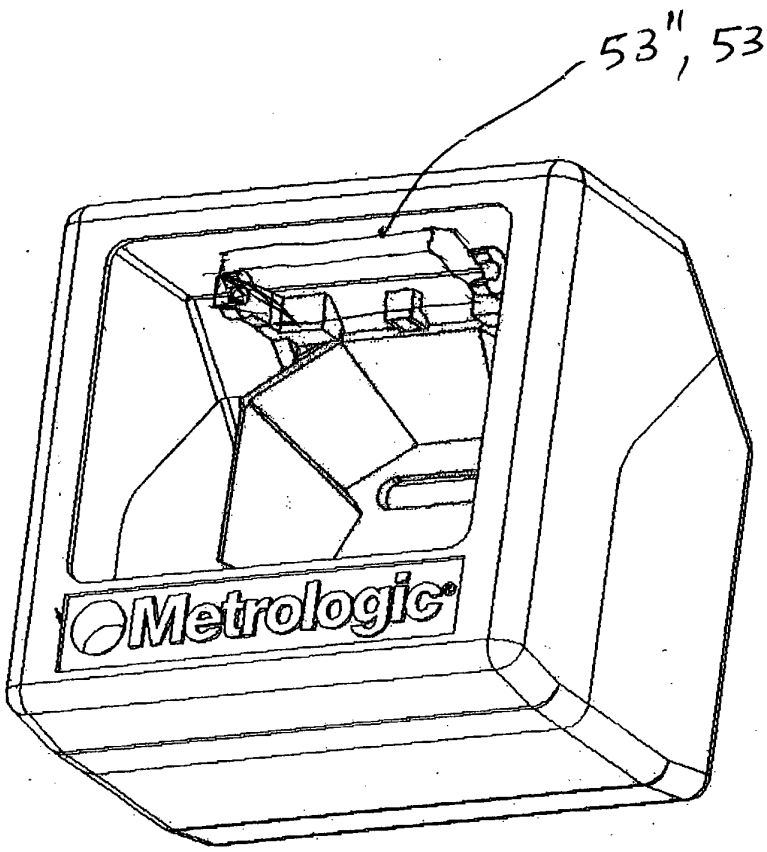


FIG. 17



Device has omni direction, multi-direction and uni-direction scanning modes of operation

FIG. 18

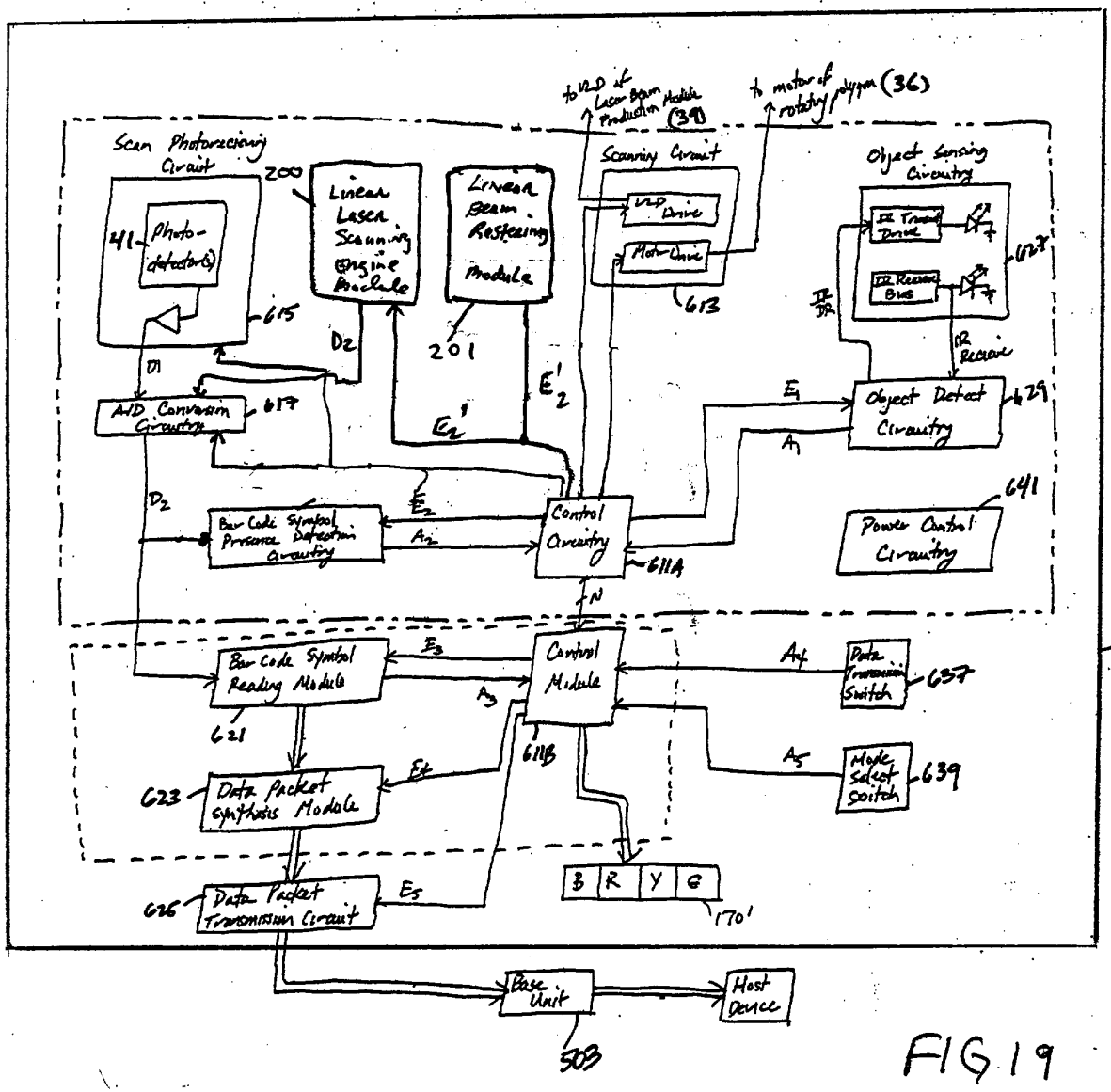
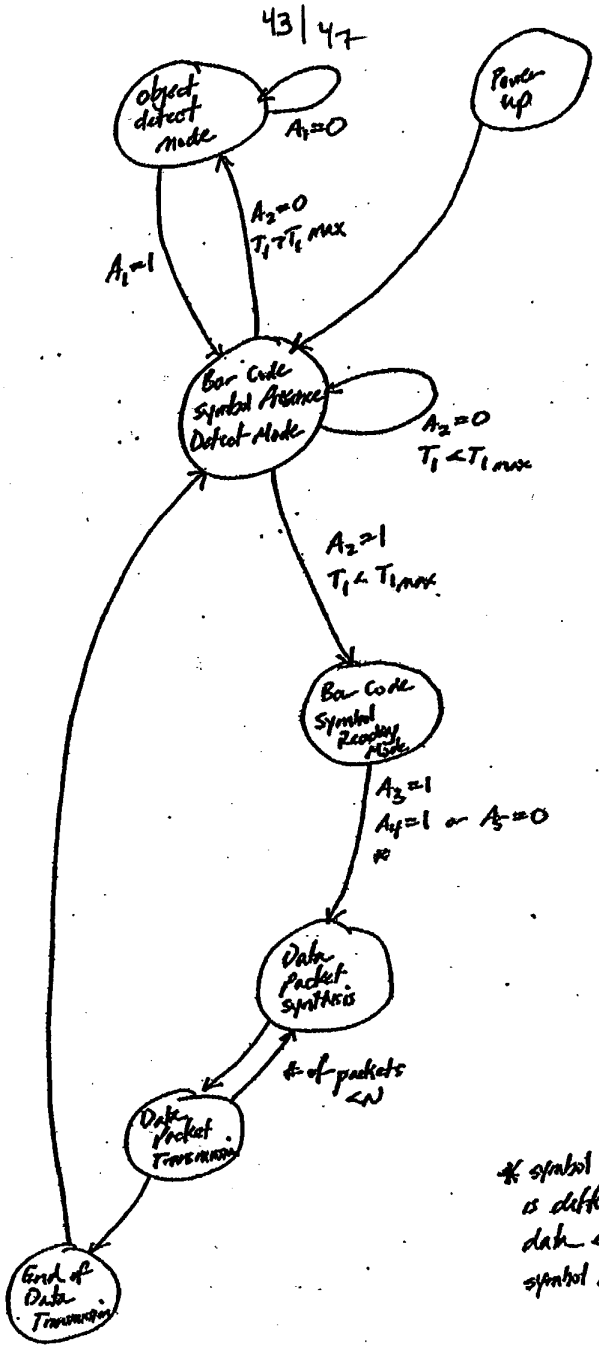

to VLD of Laser Beam Production Module (31)
to motor of rotating polygon (36)
Scan Photoreceiving Circuit
200
Linear Laser Scanning Engine Module
Linear Beam Steering Module
Scanning Circuit
Object Sensing Circuitry
41
Photo-detector(s)
615
VLD Drive
Motor Drive
613
IR Transmit Drive
IR Receive Bus
627
IR Xmit
IR Receive
D1
D2
201
E'2
E'1
A/D Conversion Circuitry
617
E1
A1
Object Detect Circuitry
629
641
Bar Code Symbol Presence Detection Circuitry
E2
A2
Control Circuitry
611A
Power Control Circuitry
N
151'
Bar Code Symbol Reading Module
E3
A3
Control Module
Ax
Data Transmission Switch
637
621
611B
A5
Mode Select Switch
639
623
Data Packet Synthesis Module
E4
B R Y G
170'
626
Data Packet Transmission Circuit
E5
Base Unit
Host Device
503

FIG. 19



* symbol character data is different than data element in decoded symbol data buffer

FIG. 20

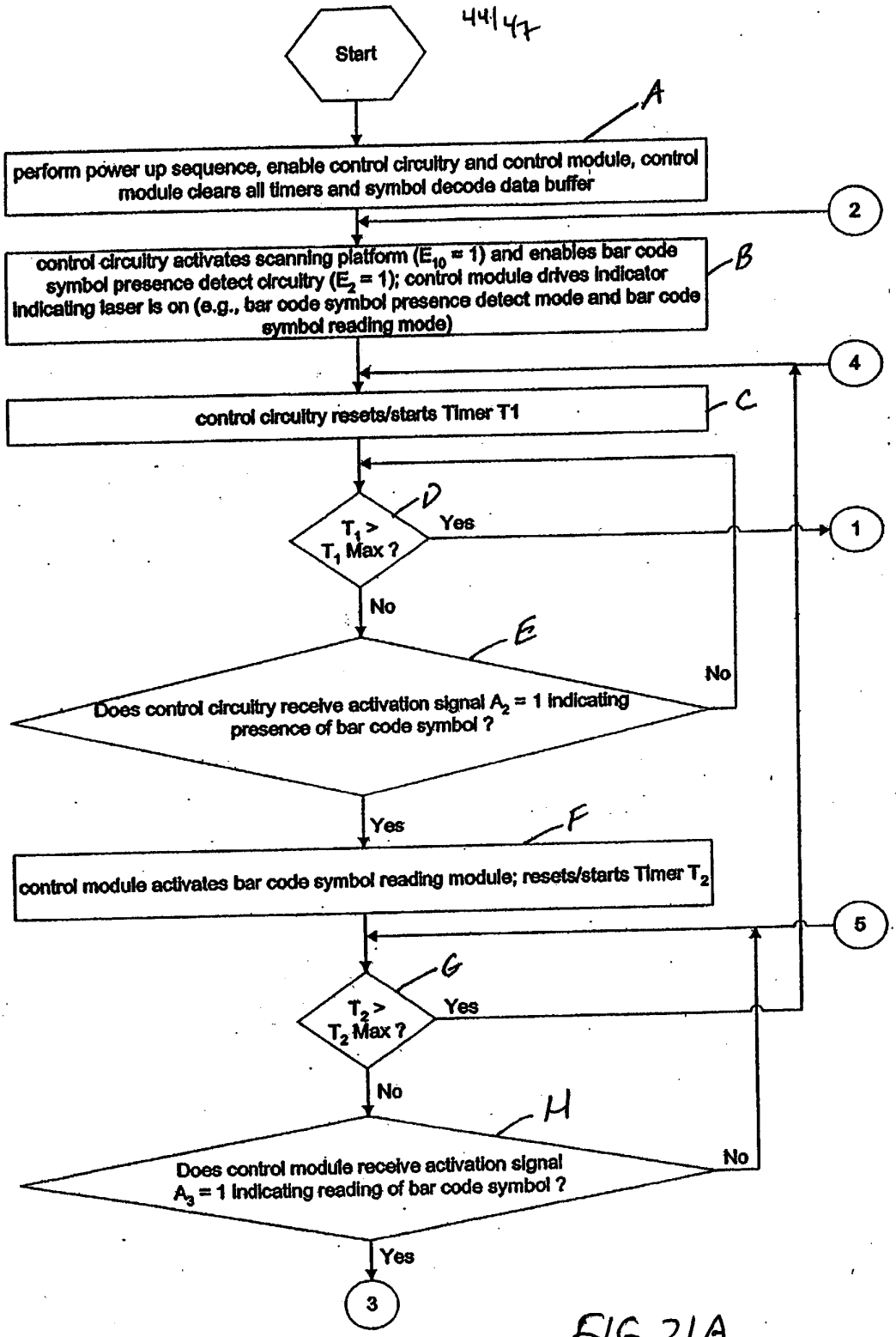

Start
A
perform power up sequence, enable control circuitry and control module, control module clears all timers and symbol decode data buffer
2
control circuitry activates scanning platform (E_{10} = 1) and enables bar code symbol presence detect circuitry (E_2 = 1); control module drives indicator indicating laser is on (e.g., bar code symbol presence detect mode and bar code symbol reading mode)
B
4
control circuitry resets/starts Timer T1
C
D
T_1 > T_1 Max ?
Yes
1
No
E
Does control circuitry receive activation signal A_2 = 1 indicating presence of bar code symbol ?
No
Yes
F
control module activates bar code symbol reading module; resets/starts Timer T_2
5
G
T_2 > T_2 Max ?
Yes
No
H
Does control module receive activation signal A_3 = 1 indicating reading of bar code symbol ?
No
Yes
3

FIG. 21A

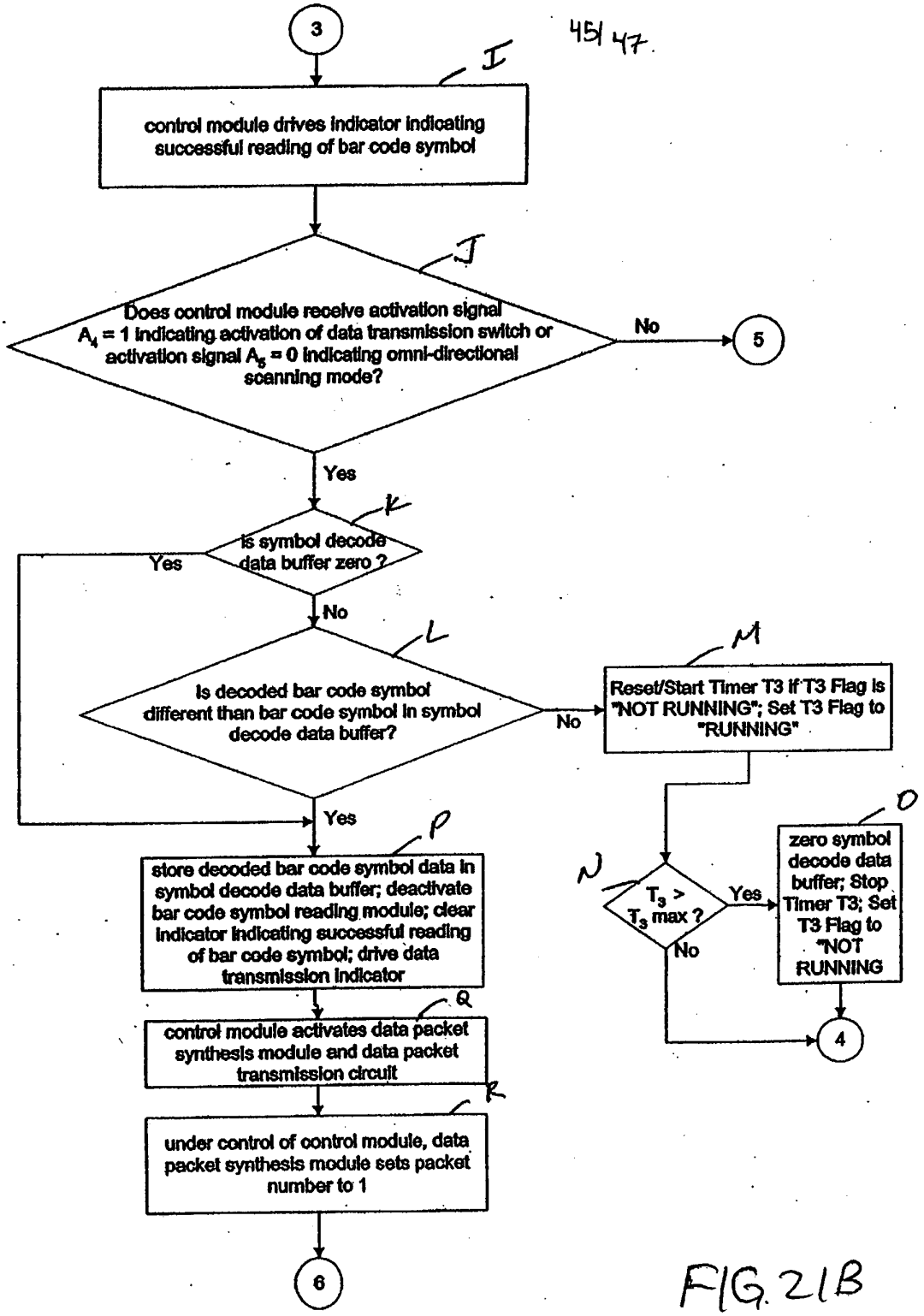

3
I
45/47
control module drives indicator indicating successful reading of bar code symbol
J
Does control module receive activation signal A_4 = 1 indicating activation of data transmission switch or activation signal A_5 = 0 indicating omni-directional scanning mode?
No
5
Yes
K
is symbol decode data buffer zero ?
Yes
No
L
Is decoded bar code symbol different than bar code symbol in symbol decode data buffer?
No
M
Reset/Start Timer T3 if T3 Flag is "NOT RUNNING"; Set T3 Flag to "RUNNING"
Yes
P
store decoded bar code symbol data in symbol decode data buffer; deactivate bar code symbol reading module; clear indicator indicating successful reading of bar code symbol; drive data transmission indicator
N
T_3 > T_3 max ?
Yes
No
O
zero symbol decode data buffer; Stop Timer T3; Set T3 Flag to "NOT RUNNING
4
Q
control module activates data packet synthesis module and data packet transmission circuit
R
under control of control module, data packet synthesis module sets packet number to 1
6

FIG. 21B

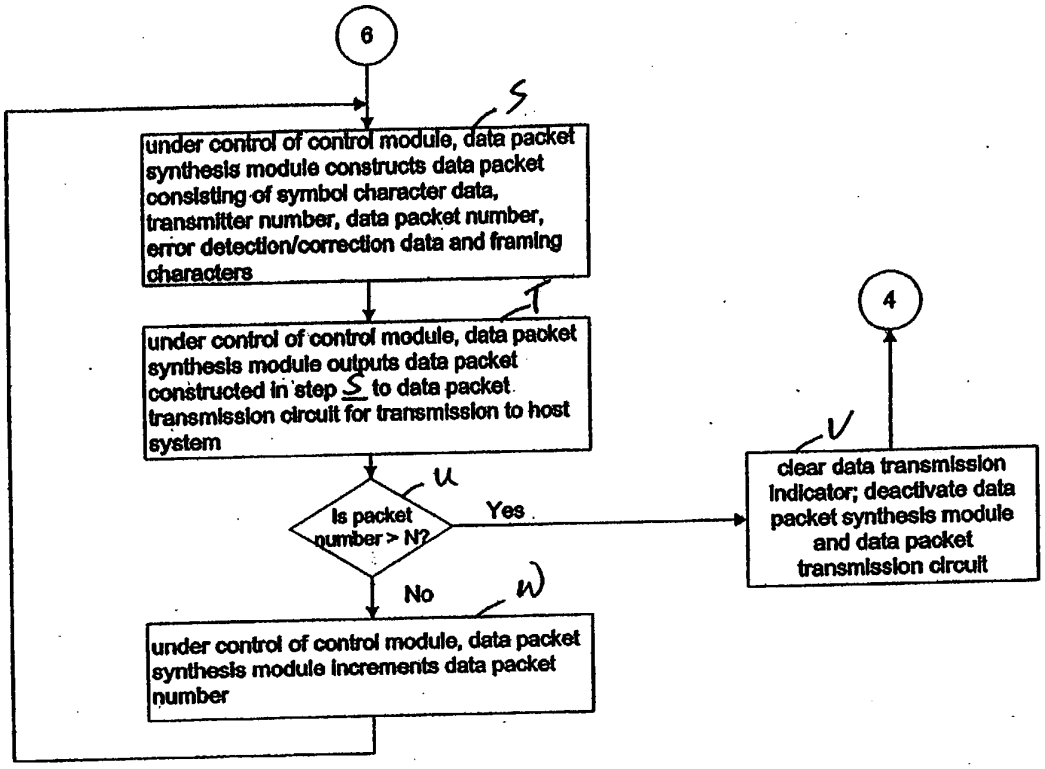

6
S
under control of control module, data packet synthesis module constructs data packet consisting of symbol character data, transmitter number, data packet number, error detection/correction data and framing characters
T
under control of control module, data packet synthesis module outputs data packet constructed in step S to data packet transmission circuit for transmission to host system
U
Is packet number > N?
Yes
No
V
clear data transmission indicator; deactivate data packet synthesis module and data packet transmission circuit
4
W
under control of control module, data packet synthesis module increments data packet number

FIG.21C

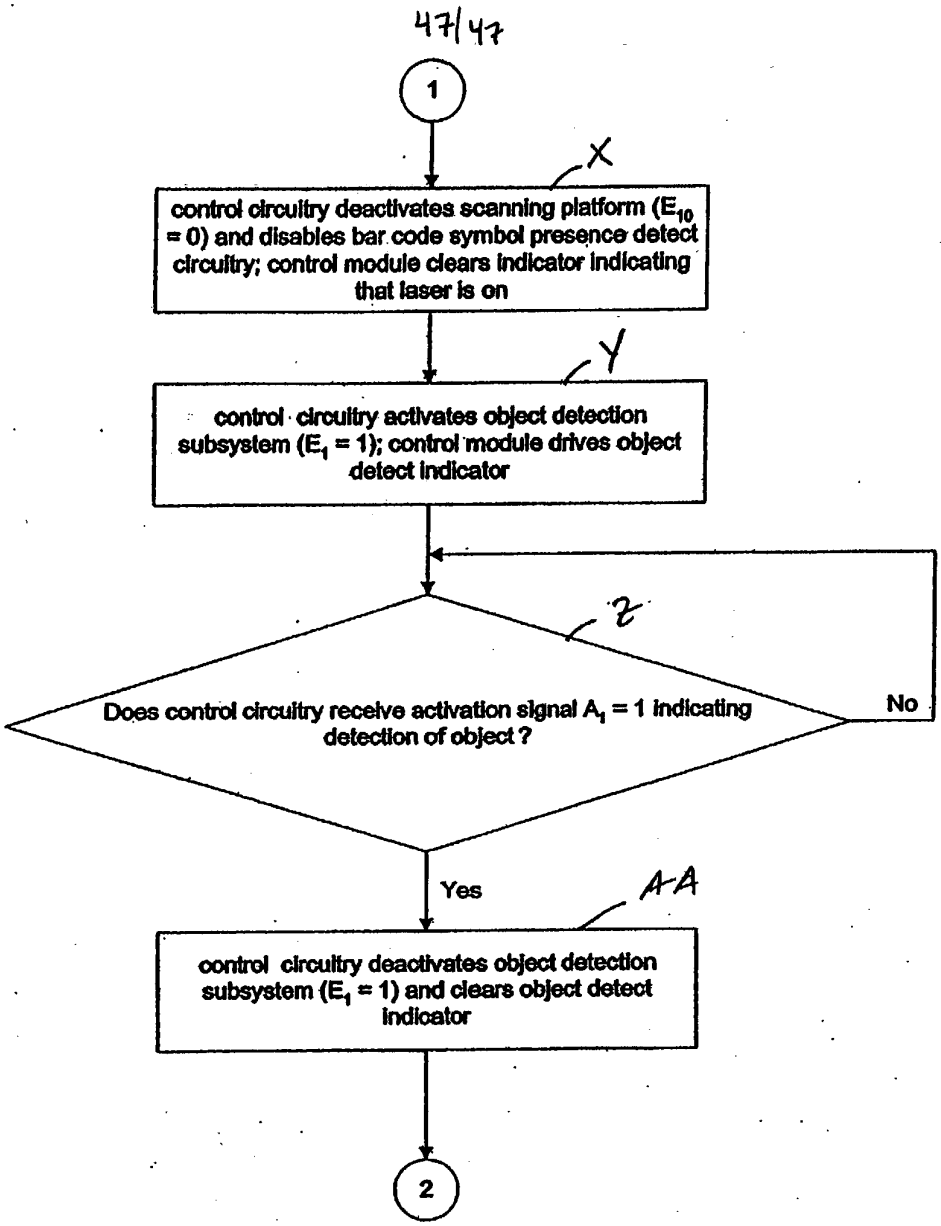

1
X
control circuitry deactivates scanning platform (E_{10} = 0) and disables bar code symbol presence detect circuitry; control module clears indicator indicating that laser is on
Y
control circuitry activates object detection subsystem (E_1 = 1); control module drives object detect indicator
Z
Does control circuitry receive activation signal A_1 = 1 indicating detection of object ?
No
Yes
AA
control circuitry deactivates object detection subsystem (E_1 = 1) and clears object detect indicator
2

FIG. 21D